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VOL LXVII 4 OCTOBER 1952 No 1734

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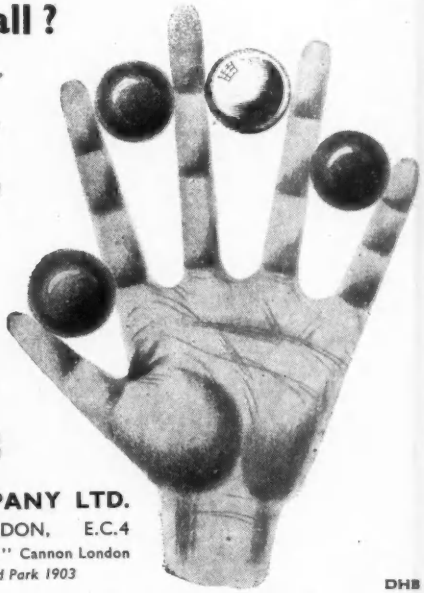

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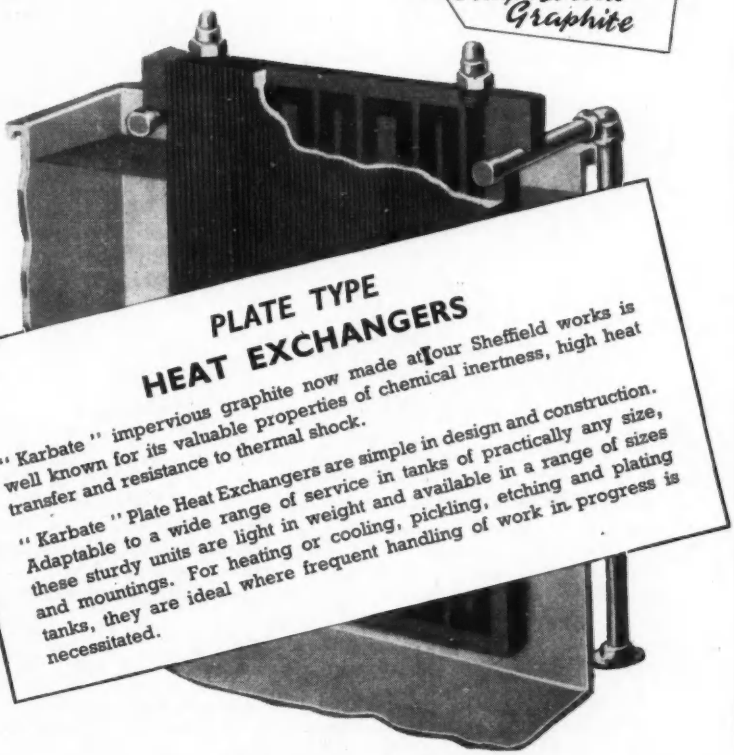

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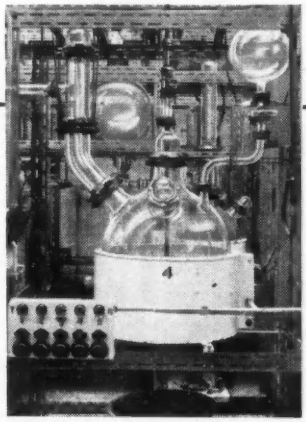

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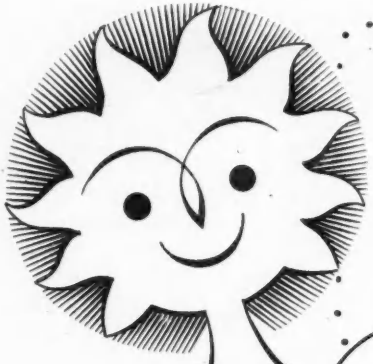

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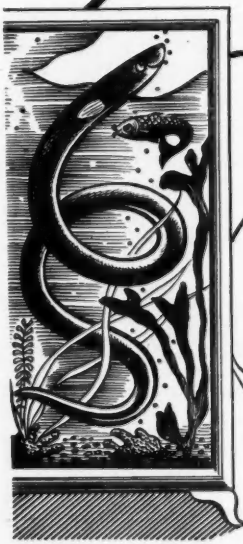

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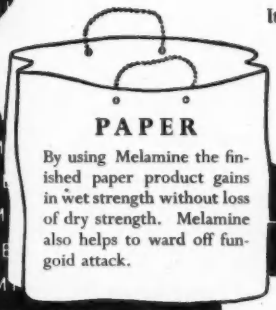

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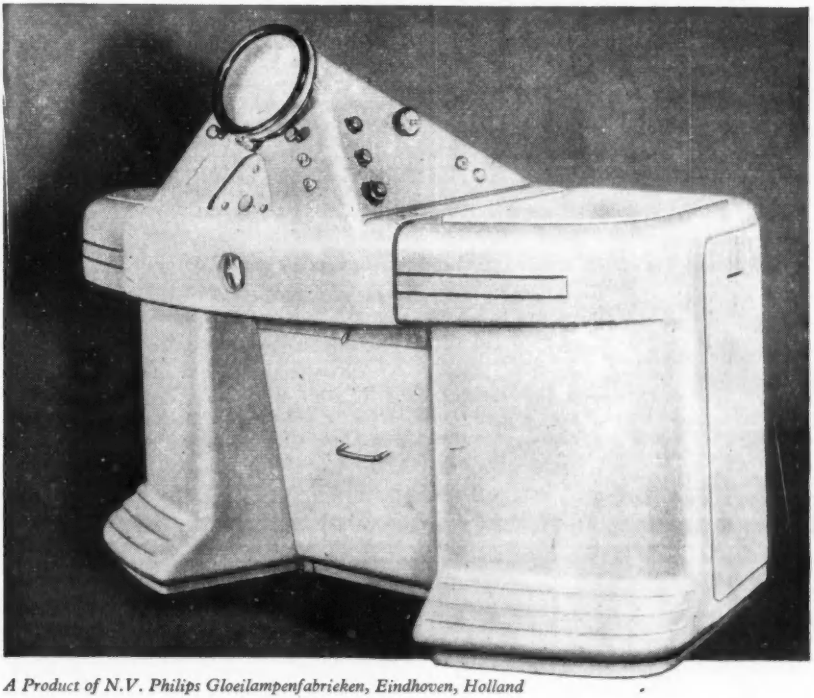

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Volume LXVII 4 October 1952 Number 1734

Consultants and Consulters

THOUGH much is said and written of the chemical profession, chemists in industry have almost invariably been employed workers; save in the special field of analysis, freelance chemists have been few and far between and seem to have left it to chemical engineers to fill the gaps. An article published in this month's *Times Industrial Supplement* indicates that today's trend is in favour of forming loosely integrated panels of consultants and this is a highly encouraging symptom. Such a panel on a large and formal scale was perhaps initiated in the United States, but here the rôle of the consultant has not been adequately recognised or organised except in the general engineering field. However, we may well deduce from this new and notable event that in recent years the tendency to rely upon independent expert advice must considerably have expanded.

Two or three generations ago the majority of the problems confronting the chemist in industry were relatively simple and solution involved little more than the application of basic knowledge. The path of application may often have been arduous, often made steeper by the reluctance of directors to give chemists a sufficiently free hand, but the knowledge required was not complex. In most productive industries that early stage has been left behind. The new and further problems impose much wider demands. Very large concerns can still rely wholly or mainly upon scientific employees; their turnover is sufficient to carry the cost of substantial establishments staffed with a variety of specialists. Smaller companies cannot do the same. Yet in the smaller companies the proportion of scientists employed — expressed per £100,000 annual turnover or per 100 workers—may in fact be greater than, or at least comparable with, the corresponding proportion in large organisations. However good the chemist or chemical engineer in a small company may be, he cannot today be a specialist in all directions; even the small laboratory department staffed by three or four chemists is limited in range of expert knowledge. Since the future of industry rests predominantly upon the effectiveness and speed with which present-day science and developments can be harnessed, it might well be implied that only the biggest productive organisations can eventually survive. Such a view ignores the service of the consultant. There is, too, another important aspect of scientific consultation. Scientists, particularly chemists and chemical engineers, are in short supply, and the prospects of

improvement in the future are not bright. This is starkly apparent when purely numerical estimates of minimum demand and maximum supply are considered; as a problem in scarcity it is much more severe when the factor of quality is also considered. For industry the crux of the matter is not how many scientists will be available but how many first-class ones. Yet how nationally wasteful it must be for one such scientist to be exclusively harnessed to the problems of one small firm, problems which in many cases will be of routine and (by today's standards) almost unscientific nature. In the past far too many highly competent men have been considerably wasted in this way; even though their careers and rewards in industry may have been satisfying, the extent to which their real scientific capabilities have been used has been small. There is much less national wastage if first-class men can work for and in industry as consultants. Moreover, it offers at least a partial solution to the threatening problem of acute scientist scarcity.

But there cannot be consultants without consulters. Although patients know they require doctors, directors are not always aware that their businesses might be much healthier if they sought and used the advice of technical consultants. In the Report of the Committee on Industrial Productivity (1949) it was observed: 'Furthermore, it is generally true that consultants are employed by the more progressive firms rather than by those which require their services most.' Yet in this country professional advertising, even when it is in effect no more than the giving of information, is so limited by tradition as to be non-existent. The bringing together of consultants and consulters, though it can be of great private and national benefit, is exceedingly difficult. The formation of relatively small panels of consultants can do much to overcome these difficulties. Industry can perhaps be made aware of the existence of such arrangements in ways that are not open to individuals—the consulter can, in fact, be informed of his own unrealised needs. Nor is the consulter left with the problem of finding a consultant appropriate for his case. The panel can provide the man, or men, whose specialised experience should cover the circumstances.

This, indeed, is the logical pattern for consultative services to follow for the future. If it is true that employed scientists cannot hope to keep abreast of every technical development, it is not much less true that one individual, operating as a private consultant, cannot be a specialist in more than a limited field. His greater freedom from routine work and his wider industrial experiences will help him but the group system obviously offers a more genuine specialist service to industry. Also, as it develops, it can foster higher standards of specialisation than those likely to be reached by consultants in individual practice, for it enables each man in the group to concentrate his attention upon his selected fields. Nor, in any case, are all problems to be solved by one branch of expert knowledge alone.

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Notes & Comments

Chemists in Canada

AS something of a tailpiece to our leader last week (CHEMICAL AGE, 67, 415-6), attention might be drawn to the scarcity of engineers and chemists in Canada. According to a survey in *Canadian Chemical Processing* (August, 1952, 10) the supply position of chemists is particularly difficult. Engineers, of whom some 1,700 graduated last year against a demand for 2,000, start in industry at an average monthly pay of $300; Ph.D. graduates in chemistry can expect, however, to start at $500 a month. These figures should be set against the average industrial wage in Canada of $230 a month. The outlook for engineer supply in Canada is far from rosy. The 1952 'harvest' of 1,700 graduates will not be repeated; 1953 will bring only 1,500 and present indications point to a drop in annual output to 1,000 graduates a year. This contrasts very dangerously with Canada's present rate of industrial expansion. The supply and demand position of chemists seems even more serious. It is said that about 50 new Ph.D. chemists could be used each year and that the average annual output—mainly from McGill University—is 35. On both sides these figures seem remarkably low. There are 9,500 chemists and chemical engineers in Canada, some 6,000 or so being chemists; an annual infusion of 30 to 50 new men can hardly cope with wastage and certainly will not fulfil the needs of any real expansion in Canadian chemical industry. However, the smallness of supply is attributed mainly to lack of teachers and teaching facilities. Even so, about a third of Canada's new chemists go to the United States for jobs.

Need Growing

CANADA'S industrial expansion is comparatively new and its current stages of development obviously create a much bigger requirement for engineers than for chemists. But Alberta alone can rapidly become the base of a huge chemical industry—a recent American prophecy is that chemical developments there will equal those in Texas during the past ten years. Canada will need to produce many more chemists each year, and in the near future, if she is to take advantage of her newly realised resources; without an adequate force of chemists she must mainly become a supplier of raw or crude materials. Perhaps it is not irrelevant to recall the comments of Sir Robert Robinson, reported here last week (p. 417), when he regretted the absence of British participation in the development of Canadian resources.

A New Toxic Risk?

FIVE doctors in the United States have reported upon an apparently new toxic hazard arising from industrial exposure to chromium compounds. The report appeared in the *Journal of the American Medical Association* of 9 August. The affected workers had been employed in chromium plating for as little as six months or as long as five years. There are known to be toxic hazards with chromium compounds that may affect the skin, nose, mouth, or kidneys, but the new trouble concerns the liver. Only one worker had actually shown symptoms of liver damage. This led to eight other workers at the same factory being examined; four of them were found to have damaged livers though symptoms had not appeared. It would appear that the toxic effect is very slow and insidious, so much so that previous evidence has probably escaped observation. Symptoms that may develop are those of liver disorder—jaundice and lack of appetite. It would be interesting to know whether any similar cases have occurred in this country; there seems little doubt that the five Chicago cases are the first of their kind to be recorded in America.

IN THE EDITOR'S POST

British Abstracts

SIR,—Your note in reply to your correspondents on the above subject is half good and half very bad.

To emphasise our need to recover our lost initiative, energy and determination is laudable, but to insist that any of the above attributes recovered should be devoted to what is now a redundant occupation is foolish in the extreme.

The only valid arguments for retaining *British Abstracts* are their possible superiority, or our inability to afford the dollars.

So long as we can apparently afford many millions of dollars annually for tobacco and films, the latter argument can hardly apply.

If *Chemical Abstracts* are adequate for our purpose, and we can afford to buy them, the discontinuance of the publication of *British Abstracts* should release 'initiative, energy and determination' for application to earning something rather nearer the necessities of life, which we are hardly earning by present methods.

This 'do or die' business is very heroic, but even the best generals prefer to use their brains as well.

Birmingham. 'DON PIP.'

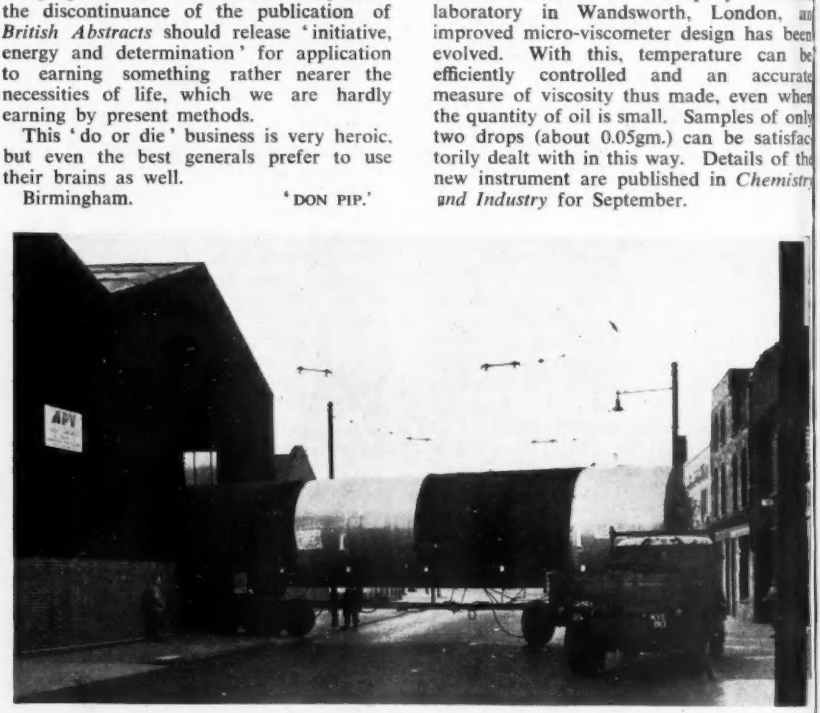
SIR,—Referring to Mr. H. R. Leech's letter in your issue of 27 September, on the subject of *British Abstracts*, I would say that the catastrophe occurred some years ago. That was when *British Abstracts* became so complex that most chemists decided to ignore this publication. My colleagues are too busy to attempt to trace references through the ramifications of the A I, II, III; B I, II, III and C subdivisions.

Another reason for ignoring *British Abstracts* is the delay in publication of indexes. It has not been possible to bind any volume since 1947 as the indexes are still incomplete.—Yours, etc.,

A. H. RAINE.

New Micro-Viscometer

AT the Vacuum Oil Company's central laboratory in Wandsworth, London, an improved micro-viscometer design has been evolved. With this, temperature can be efficiently controlled and an accurate measure of viscosity thus made, even when the quantity of oil is small. Samples of only two drops (about 0.05gm.) can be satisfactorily dealt with in this way. Details of the new instrument are published in *Chemistry and Industry* for September.



Getting this 22,400-gallon aluminium tank out of the APV works at Wandsworth and through the streets of London was a ticklish job for Messrs. Pickfords. It measured 50 feet long by 10 feet diameter and was mounted on a trailer towed by a lorry

Brewing Industry Research Foundation

New Amino-Acid Identified

IN recent months a good deal has been written and said concerning our weakness in Britain in speedily applying the results of pure research, and in general this is a fair criticism. On the other hand some of the industrial research institutes in the U.K. have been responsible for greatly increasing the world's knowledge of fundamentals. Their international standing is largely the result of the fact that they have occupied themselves first with theoretical studies and then with applying this new knowledge to their own industry. They have, therefore, benefited not only their own members but other industries as well and mankind as a whole. Judging by what was seen and heard during a recent Press visit to the Brewing Industry Research Foundation at Nutfield, Surrey, further benefits can be expected reasonably soon. Already new structures for humulone and lupulone have been discovered and a hitherto unrecognised amino-acid has been isolated and identified.

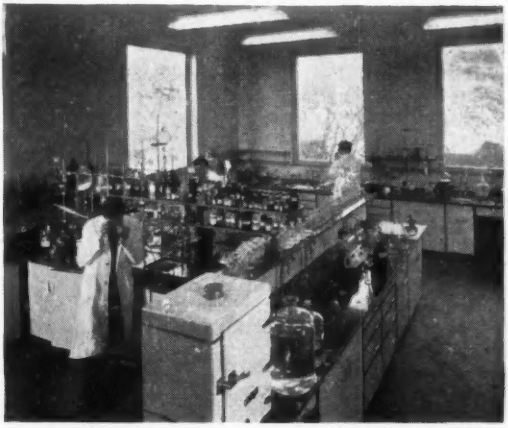
Although the Institute of Brewing has sponsored (since 1919, under its Research Fund Scheme) research into many aspects of brewing it was not until early in 1946 that the establishment of a co-ordinated research institute was contemplated. Towards the end of 1948 a suitable property was purchased and reconstruction was eventually commenced at the beginning of 1950. The property was Lyttel Hall, near Nutfield in Surrey, about 2¼ miles from Redhill, and it was a moderately sized country home with over 40 acres of gardens and well-built stables and outbuildings. It was ideally suited for conversion and apart from a modern canteen and lecture building no additional buildings had to be erected. The work was completed a short while ago and the Institute is now in full operation.

In April, 1949, the Institute was fortunate enough to obtain as director of research the services of one of Britain's leading organic chemists, Sir Ian Heilbron, D.S.O., F.R.S., D.Sc., Ph.D., F.R.I.C. Sir Ian, who is chairman of the Advisory Council for Scientific and Industrial Research and Professor Emeritus of Organic Chemistry, London University, is not only an eminent scientist but also an efficient organiser and planner.

The laboratories were planned by Sir Ian and his assistant director, A. H. Cook, F.R.S., D.Sc., Ph.D., D.I.C., F.R.I.C., and it is probably equal to any industrial research establishment to be found on the Continent or in the U.S.A.

The functions of the Applied Division may be said to be:—

1. The analytical study of the composition of the materials of brewing. This in-



The main organic chemical laboratory

cludes the examination of barley by screening and grading, germination tests and the determination of the total nitrogen content. Similarly the examination of hops includes the determination of its active principles while the examination of beers involves such estimation as 'original gravity,' foaming quality and colour.

2. By means of the small scale breweries to examine the brewing process in order to establish the best conditions of control to ensure the quality of the beer and the economy of the process.

3. To ascertain the conditions of brewing which determine the character of the finished beer.

4. To examine and select new varieties of barley and hops to assist the plant breeders of the National Institute of Agricultural Botany (Cambridge) and Wye College (Kent). This involves both analytical technique and direct brewing trials.

Experimental Breweries

The small scale breweries are designed for experimental purposes. They are not primarily intended to produce commercial beers, but generally to study the brewing process from all aspects, including the use of new varieties of barleys and hops, pure yeasts, etc. Of these breweries the larger is a feature of the laboratories and is the only one of its type in the world. It was specially designed for the Foundation and has attracted wide interest. The construction throughout is of stainless steel and was carried out by the Aluminium Plant and Vessel Co., Ltd. It consists of duplicate units, one of which can be maintained as a control while the other is being used for a variety of experimental brews. Fermentation is effected in stainless steel vessels in an air-conditioned room. Ancillary plants for operations such as carbonating, chilling and filtration, form important features of the lay-out, which thus embodies in miniature a completely self-contained brewery.

A prime topic of importance in the Microbiological Laboratories is the National Yeast Culture Collection, which is being built up for the benefit of science and industry alike. This entails far more than the mere controlled growing of yeast, for yeasts are very varied in their character and requirements. They have to be re-cultured at frequent intervals under completely sterile conditions in order to prevent contamination with air-borne yeasts, moulds or bacteria. Periodically their characteristic properties are examined which entails many biochemical evaluations as well as microscopical observations.

Survey of Brewing Yeasts

A survey of British brewing yeasts is being made so that ultimately it may be possible to produce yeasts of known character for the use of brewers. A survey is also being made of so-called 'wild' yeasts—yeasts which sometimes contaminate beers to their detriment.

Special types of bacteria are highly detrimental to the brewing process and hence are being studied so as to obtain a complete picture of their habits in the hope of providing a key to their ultimate elimination.

Malting research can only progress by a more complete knowledge of the initial processes of barley germination, and this subject is being examined from many angles, including the possible effects of weedkillers, fumigants and other chemical agents now being used in ever increasing amount in agriculture.

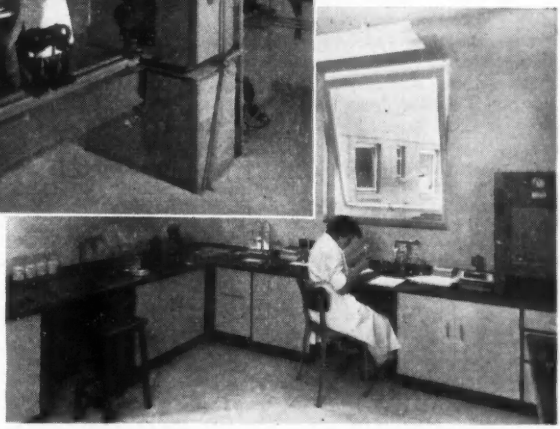
In addition to carrying out routine testing of materials, the Analytical Laboratory is concerned with the investigation of many problems of an industry-wide nature. Older methods are being examined to determine whether they conform to the more stringent requirements of modern times and attempts are being made to apply recent discoveries in chemistry and physics to analytical problems. The estimation of moisture in barley and malt, an estimation of considerable economic importance, has been found to be a formidable problem and is now being investigated from a fundamental point of view with the object of establishing a method which will be both accurate and simple to carry out.

An important part of the work of the laboratory is the development of methods for the estimation of those materials which occur only in minute traces, and increasing use is being made of the emission spectrograph and the ultra-violet spectrometer.

In the Biochemical and Organic Laboratories the study of the chemistry and biochemistry of the raw materials which form the basis of the malting and brewing processes, and the changes undergone by them during these processes, are being carried out.

The preparation of malt from raw barley

Electrophoresis laboratory



Yeast culture laboratory

involves soaking the barley grains in water and allowing slow germination of the seeds to take place. It has been established here that this preliminary treatment serves not only to supply water to the grains, but also to remove substances which prevent or retard their proper germination. The isolation of the latter natural growth materials, a task of no small difficulty, is being carried out.

The barley-grain is effectively a storehouse for materials, mainly starchy and protein-like in character, which are broken down by the enzymes present in the living cell into simpler substances, e.g., sugars and amino-acids. While these are utilised to some extent in germination, they largely remain available in the finished malt for supporting yeast growth. The recognition of the substances present in the raw barley is important in this connection and is being investigated together with the changes which they undergo during malting.

A hitherto unrecognised amino-acid, which is a constituent of raw barley and of malt, has been isolated and identified. The functions of this substance in germination and in yeast nutrition are being examined. A similar study is being made of a new sugar which has also been isolated here recently from barley, malt and hops.

During these investigations advantage has been taken of the recently developed techniques of chromatography on ion-exchange resins and on filter paper.

A study has now been made of the sugars and amino-acids of wort in order to ascertain the effects of the individual substances on the growth of the yeast and fermentation induced by it. The corresponding constituents of hops have also been studied. Hops contain, in addition, the preservative principles, or resins, which serve the dual purpose of protecting the final beer from attack by undesirable organisms and of providing flavour. Although the importance of these resins has been recognised for many years, not only has their full significance still to be elucidated, but the changes which they undergo during brewing remain only imperfectly understood.

A fundamental study of these substances is therefore in hand and new chemical struc-

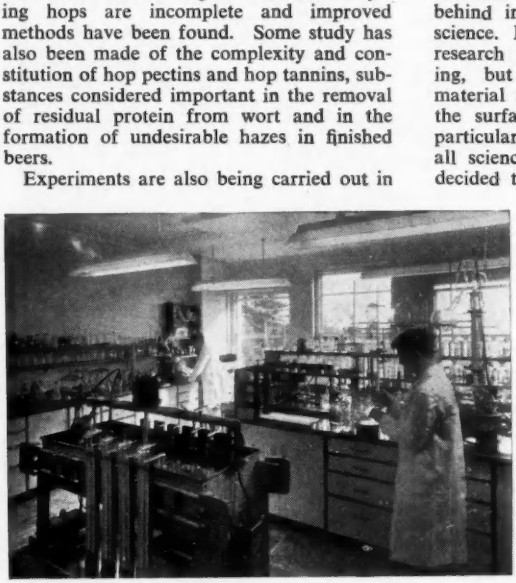
tures have been advanced for the two major constituents, humulone and lupulone. Examination of the remaining resin has yielded a new compound, humulinone, and the isolation of other constituents using the newest techniques including countercurrent extraction, is being vigorously prosecuted.

Allied work in these laboratories has shown that the existing methods for analysing hops are incomplete and improved methods have been found. Some study has also been made of the complexity and constitution of hop pectins and hop tannins, substances considered important in the removal of residual protein from wort and in the formation of undesirable hazes in finished beers.

Experiments are also being carried out in order to determine the value of substances derived from hops, wort, and yeast itself in promoting the growth of yeast and its fermentative ability.

The physical chemical laboratories are largely designed for the study of the proteins associated with brewing materials. These proteins are of fundamental importance in the brewing process providing, for example, the starch-splitting enzymes which convert the barley and malt starch into the sugar which is subsequently fermented to alcohol by the yeast. Other proteins provide essential foods for yeast growth and stabilisers for the familiar head on beer. On the debit side the proteins are responsible for troublesome hazes which sometimes mar even the most carefully treated finished beer. Attempts are being made to separate and isolate the proteins of barley and malt. Full use is being made of light scattering apparatus, the ultracentrifuge and electrophoresis apparatus.

At a luncheon held at Lyttel Hall on the day of the Press visit, Sir Ian said that if fundamental science was not continued we would soon run out of applied science. He had been depressed during a recent visit to America to see how Britain was lagging behind in the applications of fundamental science. In the brewing industry the applied research was good, especially in engineering, but there was a large source of material which had yet to be brought to the surface. This depended not on one particular science but on the marriage of all sciences and the brewing industry had decided to explore the unchartered seas.



Biochemical laboratory

The problems could not be attacked except by a united effort. The foundation was the beginning of what might be centuries of research, for science never ends. They were engaged largely in fundamental research and they were not going to try to give the world a beer which they felt it should drink.

The yeast cell had given the world vitamins and there were other related things such as penicillin which were of interest and value to the whole world. It might ultimately be that the Institute would produce an antibiotic superior to streptomycin. He hoped that the Brewing Industry Research Foundation would become a centre of knowledge not only for the brewing industry but for mankind as a whole. He hoped that it would become a prototype applied research laboratory.

Birmingham Symposium

Analytical Chemists From 12 Countries Meet

THE Midlands Society for Analytical Chemistry held a symposium on 11-12 September, which was attended by a number of foreign chemists, including some with international reputations in the field of analytical chemistry.

On the first day papers mainly devoted to the theoretical aspects of analytical chemistry were read. On the second day the papers were concerned with original methods. Amongst the new methods described were a spot test for copper more sensitive than any hitherto recommended, a new reagent for the direct titration of water, the use of mercury in the presence of complex mercury compounds as a selective reducing agent, a complex cobalt compound for the precipitation of sulphate, a complex cobalt-ethylenediamine reagent for the gravimetric determination of antimony, the use of the oscilloscopic polarograph for the rapid qualitative analysis of inorganic and organic substances, and an accurate and novel electrolytic method for determining traces of oxygen in other gases.

Many Foreign Visitors

Among the distinguished foreign visitors, some of whom read papers, were Professor J. Gillis of the University of Ghent, who is chairman of the Reagents and Reactions Commission of IUPAC (International Union of Pure and Applied Chemistry), Professor C. Duval of the Sorbonne, secretary of the Commission, Professor F. Burriel-Marti of the University of Madrid, also a member of the Commission, Dr. H. K. Malissa of Graz, secretary of the Austrian Microchemical Society and also of the Microchemistry Commission of IUPAC, and Dr. J. Unterzaucher of Leverkusen, well known for his development of the method for the direct determination of oxygen in organic compounds.

At the end of the first day's session the delegates attended a civic reception given by the Rt. Worshipful, the Lord Mayor of Birmingham at the Council House, followed by a buffet tea. This was followed by a dinner in the evening at the White Horse Hotel, Birmingham. Mr. J. R. Leech, chairman of the Society proposed the toast of the foreign guests to which Professor Gillis responded with a wit and humour rarely heard on such occasions.

Professor M. Stacey, F.R.S., spoke on the value of research work in analytical chemistry carried out in the University of Birmingham, to other research teams within the University. The statement was often made that unlike the U.S.A. and the Continent, no Chair of Analytical Chemistry existed in Britain. It should be remembered, however, that the system of designating university staff in this country was very different.

Professorships Abroad

For example, Senior Lecturers or Readers in special subjects would automatically have the title of Professor in most Continental universities and certainly in the U.S.A., where the title was used for fairly junior members of staff. On this basis several universities in Britain could claim a Professor of Analytical Chemistry. It would be impossible to install Chairs in every university and it would be undesirable for only one or two universities to possess such a Chair. The best solution would be for every university to put this branch of chemistry under the wing of a Senior Lecturer or Reader. In this way the general teaching of analytical chemistry would be enhanced on a large scale.

One of the Largest in the World

Professor Stacey also pointed out that although the Research School of Analytical Chemistry at Birmingham University which was now one of the largest in the world, had only been developed over the last four years, the Chemistry Department could claim contributions to the subject going back for two generations. For example, the organic microchemical laboratory was the first ever set up in Britain and Morgan's classical work on chelate compounds was conducted at Birmingham.

About 180 delegates attended the Symposium and included visitors from Sweden, Finland, Austria, Germany, France, Belgium, Holland, Spain, the U.S.A. and South America.

ILO Recommendations

General Principles For Vocational Training

HOT meal facilities for workers on night shifts, assistance in securing transport at night, short breaks without loss of paid time for meals, time to put on and take off protective equipment, and, in general, an interval of not less than 16 hours between two consecutive shifts, are among the recommendations made by the International Labour Organisation's Chemical Industries Committee which concluded its third session in Geneva on 20 September.

Committee's Recommendations

The Committee made the recommendations in a resolution adopted for 'the guidance of those concerned with the preparation of laws and regulations or with the rendering of an arbitration award, or the negotiation of a collective agreement,' relating to shift work in the chemical industries.

The resolution was adopted unanimously by government, worker and employer delegates attending the meeting.

The Committee's recommendations cover hours of work and arrangement of shifts, rates of pay, overtime, and facilities for the welfare of shift workers.

A schedule annexed to the resolution suggests how 40, 42, 44 and 48-hour shifts may be worked out.

The Committee turned down by 46 votes to 28, with three abstentions a suggestion by the workers' group that the resolution should stipulate the additional percentages to be paid for shift and overtime work.

The Committee also rejected by 38 votes to 33 with five abstentions, a suggestion that 'overtime work should as far as possible be compensated by a corresponding amount of time off.'

The employers' group on the Committee held that these questions should be dealt with by the normal process of negotiation operating in each country.

The Committee unanimously adopted a set of general principles to be applied in the vocational training of chemical workers, and invited governments, employers and workers alike to facilitate their implementation.

Such vocational training, it said, should be aimed at developing to the fullest extent the latent abilities of the employees and permit them to receive recognition for their skill through promotion to a higher grade.

It recommended that all vocational training programmes should include instruction in safety and health; that the training of young workers should be of a systematic nature and should help them develop pride in their work, a sense of responsibility, knowledge, dexterity and physical fitness; and that the training of supervisors should include instruction in human relations.

The Committee asked the International Labour Office, the permanent secretariat of the Organisation, to inform Governments and employers' and workers' organisations of the results obtained in vocational training in various countries and to continue its own studies in the matter.

The Committee also adopted by unanimity the recommendations of its group of experts on the classification and labelling of dangerous substances.

The experts had asked the ILO to continue its efforts with a view to arriving at the adoption, for use in international trade, of five symbols characteristic of the chief types of danger associated with the handling of dangerous substances.

They also had asked the ILO to undertake the preparation of a list of substances for which the above-mentioned symbols should be used.

The findings of the Committee are to be transmitted to the Governing Body of the ILO for necessary action.

Agenda Proposed

The Committee proposed that the following agenda be adopted for its next session:

(1) Improvements in productivity obtained in the chemical industry from systems of payment by results and from techniques concerned with their application.

(2) Problems arising and measures to be taken in regard to safety and hygiene.

(3) Industrial relations in the industry with particular reference to the underdeveloped countries.

(4) The question of reduction of hours of work in the industry with due consideration to prevailing conditions.

The session was presided over by Antoine Fafchamps, government delegate, Belgium, on behalf of the Governing Body.

Chemical Research Laboratory Open Day

A Review of Work in Progress

ON Tuesday, 23 September, the Chemical Research Laboratory of the DSIR staged an open day to show the progress of the work it is at present engaged upon. This covers a very large field, and the resulting exhibits were evidence of a very active programme of research.

In the organic section several pieces of apparatus were on view. Fractional distillation equipment used at the Laboratory could be seen, this consisting of a number of columns of differing capacity and plate efficiency, suitable for a wide range of preparative and analytical procedures. Still heaters, stills, reflux heads and pressure-controlling and measuring devices, as well as specimens of various types of fillings for fractionating columns were also shown. A platinum resistance thermometer was exhibited, and a number of triple point ice cells.

Another piece of apparatus displayed in its working state was a precision manostat. This had been constructed out of specially selected, approximately ¼ in. glass tubing to lessen the errors of meniscus distortion. The mercury used was originally distilled directly into the apparatus and condensed there to ensure purity. Means for taking accurate cryoscopic and ebulliometric measurements for the estimation of the purity of substances were also to be seen, including an automatic freezing point recorder. The rate of cooling in this could be adjusted by changing the pressure inside the Dewar flask.

Anti-TB Drug Base

Some pyridine derivatives of current interest were exhibited in one part of the organic section. These included specimens of *iso*nicotinic acid, the basis of the new anti-tubercular drug under clinical trials—*iso*nicotinyl hydrazide. A distinctive qualitative test for it was shown.

A method for the determination of sulphur in sulphur-containing compounds was described. It is necessary to ascertain this sulphur if the value of $-\Delta U$ is to be obtained, since the presence of sulphur in such substances as hydrocarbons causes inaccuracy in the obtained value of $-\Delta U$. The estimation of the sulphur present is carried out by burning 1 ml. of the substance in air over a catalyst of vanadium pentoxide, at 900°C., oxidising the resultant SO_2 with hydrogen peroxide and estimating the H_2SO_4 produced turbidimetrically as barium sulphate. Sulphur can be estimated at concentrations of from 1-100 p.p.m. in this manner.

The method of analysis of the products of the bomb calorimeter was also displayed. This consisted of a train of reagents through which the products were passed. In the accurate determination of the heat of combustion of nitrogenous organic compounds, the fate of the nitrogen must be determined accurately in order to give the necessary heat correction to $-\Delta U$ found, and so give $-\Delta U^\circ_c$ for the pure reaction. This work was being done in conjunction with the National Physical Laboratory.

Oxygen Purification

The purification of oxygen constituted one exhibit. The best commercial oxygen nowadays is produced by circulation over hot copper at 500°C., followed by passage through an ascarite tower, at 100 atmospheres. The resultant gas contains approximately 0.5 per cent argon and 0.001 per cent nitrogen only.

The Alexejeff method for determining the miscibility of pyridine homologues with water was described, and in a neighbouring exhibit some results of investigations into vapour-liquid equilibrium measurements on infinitely dilute solutions of pyridine and its homologues were on view. These solutions are very far from ideal. Lutidines have been found to have activity coefficients of ca. 100.

Also on show in the organic purification and measurement section were a critical angle refractometer and a double-beam spectrometer for infra-red and ultra-violet adsorption.

In the organic intermediates section were shown some standard samples of hydrocarbons prepared by the C.R.L. These are ampoules sealed *in vacuo* and containing various hydrocarbons of high purity for use as reference compounds in spectrographic analysis and for other purposes. The

apparatus used for sealing the ampoules could be seen. Low temperature stills were also on view, for use in preparitive work on hydrocarbons up to C_4, including the Podbielniak 'Hyd-Robot' in which an attempt is made to bring all the problems involved under automatic control. Spinning-band fractionating columns were exhibited, as well as a continuous still for solvent recovery, and various reflux units. Applications of isotopically labelled carbon compounds formed one exhibit and the results of study of carbon dioxide and its reactions at high pressure another.

High Polymers

In the high polymers section were displayed methods for the preparation of ion-exchange resins and results of the study of the relative affinity coefficients for anion-exchange resins. Cation-exchange equilibria and kinetics have also been under study, and the influence on these exercised by variations on the polymer structure. A monofunctionality test for the study of anion-exchange equilibria was demonstrated in which was measured the uptake of chloride ion by four weakly basic resins at different *p*H and concentration of chloride. The separation of substances by ion-exchange of chromatography could be seen, the separation of the β- and α-resorcylic acids being displayed. The function of ion-exchange resins when used as 'ionic sieves' was explained by a model and demonstrated by the separation of a mixture of two dyes, Victoria Blue and Auramine O—these two products having a marked difference in molecular size. The mixed bed deionisation of water was also explained and the apparatus shown. An exhibit was devoted to semi-permeable membranes and their uses in osmometry and dialysis.

In the Hales Building could be seen an exhibit dealing with the metabolism of sulphate-reducing bacteria. It has been found that sodium selenate inhibits the reduction of sodium sulphate by these bacteria, in such a way that the amount of selenate needed to inhibit the reduction depends on the amount of sulphate present. The organisms will also reduce methylene blue in the absence of air, provided an oxidisable carbon compound or hydrogen is present. The reduction was demonstrated in test tubes. It has to be carried out in the absence of air since reduced methylene blue re-oxidises in air. Setting the medium with agar prevents access of air and enables the test to be carried out simply. The end-products of the metabolism of these bacteria are separated by paper chromatography, the operation of which was shown.

The rest of the microbiology group exhibits concerned the bacterial sulphur cycle, a continuous process for the bacterial reduction of sulphate, and the national collection of industrial bacteria. The continuous process was demonstrated by a diagram of an anaerobic continuous culture, as well as examples of the apparatus used and a flow diagram. Photographs of the apparatus used for a continuous culture of *Desulphovibrio desulphuricans* were on view.

The exhibit devoted to the national collection of bacteria showed interesting diagnostic tests for recognising the bacteria. Some bacteria produce characteristic and colourful pigments if grown on certain media. These pigments can be recognised by their colour, solubility or otherwise in alcohol and in water, and other individual characteristics. Methods of preservation and maintenance of these bacteria were depicted as well as means of classification. Finally, some of the antibiotic-producing cultures such as *Penicillin notatum* could be seen growing on Petrie dishes.

Pure Metals on Show

The Inorganic Group of the C.R.L. showed several exhibits on metals. One of the most interesting was the collection of pure metals. These are the responsibility of the Collection of Pure Metals Committee of the Chemical Research Board. and the metals they possess fall into three categories, A, B or C, depending on the extent of their purity. In group (A) at the moment are Al, Cd, Cu, Ga, Ge, In, Pb, K, Sn, and Zn. Group (B) consists of Ba, Co, Ni, Na, Ta and Ti, and group (C) of Sb, Mn, Nb, V, Zr. Several of the above pure metals were on show.

The preparation and properties of gallium were also described, examples of the metal being on show. The extremely wide liquid range of this metal makes it potentially suitable for thermometry above the temperature of 500°C, where mercury cannot be used. To contain the metal fused quartz could be used instead of ordinary glass. Similarly, the metal and some of its alloys may be useful for gas seals and low-melting

fuses (it melts at 29.8°C.), and it could be used as a substitute for mercury in pressure gauges—since its density is less than half that of mercury the instrument would be more than twice as sensitive as the present ones. Other possible uses are for coating optical mirrors and as a substitute for mercury in ultra-violet ray lamps.

The purification of germanium was the subject of an exhibit. Particularly troublesome impurities in this metal are arsenic and boron. A method developed at the C.R.L. is based on radioactive tracer studies. Pure GeO_2 is prepared by this means containing less than 0.01 p.p.m. arsenic (the estimation of this arsenic is done by the activation method of A. A. Smale, see *Chem. and Ind.*, **23**, 441 (1950)), and less than 0.15 p.p.m. of boron. The dioxide is then heated in pure hydrogen.

Uses for this metal are coming into their own. As well as being of great service in radar and similar applications as a rectifier for microwaves, germanium crystals act as transistors and may replace the triode valve. A recent development has been the use of germanium dioxide as a substitute for silica in glass for producing a glass with a high refractive index. Other notable properties of the metal are its light weight, extreme hardness, corrosion-resistance, expansion on solidification, and high electrical resistance. Films of the metal are easily produced and may be used as resistors, while alloys with gold and other metals are also of industrial interest. British coal flue dusts contain up to 1.4 per cent germanium and 1.6 per cent gallium on an average.

Microanalytical Methods

In the field of microanalysis methods were described for the analysis of carbon, hydrogen, nitrogen (Dumas method), halogens (Carius method), sulphur (Carius method), and phosphorus. Electrometric titration for halogens was also demonstrated. Spectrographic analysis instruments on view included a spectrum projector comparator, a large Littrow spectrograph, a medium spectrograph and Spekker photometer, a 'multisource' excitation unit, a non-recording microphotometer, a Jarrell-Ash grating spectrograph and a Beckmann flame spectrophotometer.

The Corrosion of Metals Group, one of the largest research groups in the Laboratory, showed a number of exhibits. Those dealing with corrosion testing techniques were displays of the various instruments used to study the extent of corrosion. These included a totally enclosed 'weatherometer' (automatic control), a paint adhesion tester for testing how far corrosion has proceeded underneath a paint covering, a light reflection meter and an impact indentation apparatus. A pressure-controlled thermostat could also be seen, as well as a very accurate air thermostat which remained at 25°C. ± 0.015°C., the maximum variation with time being 0.005°C.

Influence of Metal Mass

In the study of corrosion mechanism, the effect of metal mass on corrosion in 'sheltered' outdoor conditions was demonstrated. The mass of a metal body governs its heat capacity, which in turn affects the amount of moisture that is deposited on its surface, which largely determines the extent of corrosion that takes place. The effect of dew point on the corrosion of steel in sulphur dioxide atmospheres was also displayed, together with examples of filiform corrosion, and the temporary protection of steel afforded by immersion in various saturated solutions at 95°C. Corrosion inhibitors in the form of packaging materials and temporary protective coverings from rubber latex, as well as corrosion-inhibitive grease and thixotropic pastes, formed the subject of another exhibit.

Tests for standardising metal phosphate coatings on steel were exhibited along with examples of some of the coatings. Properties of these coatings which are investigated are their amount and composition, water content, hygroscopicity, absorption and corrosion-resistance.

In the high temperature oxidation section was shown the apparatus used for exposing metal samples to flue gas atmospheres.

The corrosion of metals in salt solutions and sea water has also been investigated at the C.R.L. A conductivity water still was shown, together with details of corrosion tests by the oxygen absorption method and under stagnant conditions at 25°C. Accelerated corrosion tests are carried out using a low speed rotor and the influence of movement at 25°C. could be observed. A high-speed rotor method was described, and the influence of temperatures and concentrations at high speeds of movement demonstrated. Tests on protective coatings by the high-

speed rotor method were also shown.

On another bench were outlined the methods of applying protective coatings, and examples of protective coatings under test. For the macro-examination of specimens the laboratory has an inspection enlarger, and for micro-examination a projection microscope. Both these could be seen. Electrochemical methods are used for studying protective coatings on immersed metals, and can be used for measuring the water uptake of painted steel. One exhibit was devoted to corrosion inhibition for use in neutral solutions and heat exchange systems, and another dealt interestingly with the use of radioactive tracers in the study of corrosion inhibitors.

Boiler tube corrosion is the subject of some study at the C.R.L. and experimental model boilers used for this were displayed, with examples of corroded and failed boiler tubes nearby.

Buried Pipe Corrosion

The corrosion of buried metals is important to industry, and the C.R.L. have devoted some research to the subject. At the exhibition examples of the internal and external corrosion of buried ferrous pipes which had been recovered made clear the damage which can be done by this means. One of the most promising methods of protecting buried pipes at the moment is by cathodic protection, and the Laboratory demonstrated the principles of this and its results. Also on show were methods for the electrochemical study of anaerobic bacterial corrosion and the study of soil samples. Field investigations on the subject formed the theme of one exhibit.

Finally, open to inspection were the radiochemistry buildings housing the radiochemical group. These buildings are situated at some little distance from the main buildings. One of the most recently discovered sources of radioactive material has been the residues of the gold mines in South Africa. Investigations on the extraction of these residues and other sources has produced improved methods of extraction and assay of other metals and ores. One exhibit was devoted to showing the recovery of gold from cyanide solutions by ion-exchange.

Exhibits dealing with the measurement of radioactivity included counting equipment and a scintillation counter for liquids, as well as an apparatus for the measurement of radioactive carbon. Analytical apparatus included a Unicam spectrophotometer, a Spekker absorptiometer, a nephelometer, and a Tinsley pen-recording polarograph.

Methods of analysis of minerals and ores were on show, among them inorganic chromatography using the paper strip technique. The solvent extraction method was also demonstrated together with measurement of fluorescence.

Separation and recovery of metal products from solution was an interesting exhibit. Ion exchange resins can be used for separation processes, together with precipitation under controlled *p*H and separation by centrifuge. An automatic fraction collector could be seen, and there was shown the continuous recording of concentration in solution by polarograph. Various ore treatment equipment was also on view.

In addition to the above rooms, the library, the glass-working laboratory—with a lathe for handling large bore tubing and some impressive samples of apparatus constructed on the premises—and the engineering workshop were also open to inspection.

Preparation of Standard Sand

THE suitability of coals for many industrial purposes, as for instance, the carbonisation and gasification industries, and for steam-raising, often depends on their caking properties. One method for assessing these properties is a modification of the Gray-Campredon test for the Determination of the Agglutinating Value of Coal, described in British Standard 705 : 1936. According to this test the agglutinating value of a given coal is defined as the maximum ratio of sand to coal in a mixture which, on heating under given conditions, yields a coherent coke of specified strength.

The sand to be used for this test is either standard sand prepared and supplied by the Fuel Research Station, or any other sand that has been proved to give the same results. Since it is likely that the test will continue to be widely used in the future, the DSIR has now published details of the preparation of the standard sand at the Fuel Research Station, with drawings of the plant used.

These particulars are given in Fuel Research Technical Paper No. 56, 'The Preparation of Standard Sand' (H.M. Stationery Office, 1s. 0d.; by post 1s. 1½d.)

Hydraulic Machinery at Harlow

Growth of the British Hydromechanic Research Association

CONTROL and motion of fluids in pipes and valves, the efficacy of seals and joints, and the use of a wide variety of centrifugal and other forms of pump inevitably play a prominent rôle in many chemical processes.

The work of the British Hydromechanics Research Association is, therefore, of considerable interest to the chemical engineer and an opportunity to review its scope and activities was afforded on 24 and 25 September, when two 'Open Days' were held to visit the laboratory at Harlow, Essex, which was opened n 1951.

Formed in 1947 by British manufacturers of hydraulic machinery under the presidency of Lord Waverley (then Sir John Anderson), the resources of the association were at first concentrated on the provision of a technical information service. Since the acquisition of its own laboratory a research programme of direct interest to members has been carried out.

A series of exhibits to illustrate some of the association's investigations was on view.

An investigation was being made to determine the effect of particle size, shape, density; and head and pipe diameter on the velocity required to transport various concentrations of solids. This information was primarily required in order to estimate the economic possibilities of hydraulic transport of minerals in bulk.

A mixture of water and ¼ in. solid particles was delivered by a 4 in. centrifugal pump round an experimental pipe circuit which included 10 ft. of horizontal 3 in. glass pipe and 10 ft. of vertical glass pipe.

Flow & Concentration

The flow and concentration were measured by collecting the delivery for a known time in a calibrated tank. The concentration in the pump suction tank was maintained uniform by an auxiliary mixing pump and the concentration of solids in the circulating system could be changed by diverting solids into and out of the larger elevated tank.

Owing to the need to measure the particle size of the solids used in the transport experiments a 15 ft. vertical glass pipe had been erected in order to determine their settling velocities. The size variation of the sample was obtained by continuous weighing of the solids as they reached the bottom and fell on to a scale pan.

In commercial pump testing it is a common practice to make the suction and delivery gauge connections at the pump flanges and to have bends or taper pieces immediately adjacent to them. This may lead to erroneous pressure measurements due to the effects of curvature and rotation of flow.

Cause of Error

Besides these effects considerable errors in the apparent suction head, at flows less than about half normal, can be caused by the impeller setting up rotation in the suction pipe.

By means of a straight length of 'Perspex' pipe connected to the suction flange of a 6 in. pump, the pre-rotation at low discharges and its effect on the suction head measurement, were clearly demonstrated.

In order to study the flow patterns in centrifugal pump impellers, and to determine the impeller characteristics independently of the influence of the casing, a test rig, in which a transparent impeller can be rotated inside a large cylindrical tank fitted with glass windows at the top and bottom had been designed and is at present under construction. Impellers of up to 16 in. external diameter, by about 5 in. overall width and eye diameter up to 8 in. could be accommodated and might be driven at speeds up to 400 r.p.m. by a 5 h.p. motor.

Preliminary work on the measurement of pulsating flow has led to the conclusion that most of the error is due to the false readings indicated by certain conventional types of manometer when subjected to pressure fluctuations. The performance of manometers was therefore being studied as a separate problem.

With the apparatus shown, manometers can be subjected to known static pressures with superimposed pressure fluctuations of variable amplitude and frequencies up to 180 cycles a minute. Tests were being made to determine the effect of the diameter and

length of the pressure connections on the accuracy of a simple mercury U-tube.

An experimental reciprocating pump was demonstrated. This was a single acting ram pump provided with valve boxes specially designed to observe the flow and measure the valve motion. The pump delivery was at present throttled and returned to the suction tank but would later be passed through a regenerative cylinder in order to allow the use of higher delivery pressures without excessive driving power.

Interchangeable Rams

Maximum pump speed available was 230 r.p.m. The stroke was adjustable from 1-12 in. in steps of one inch, there was provision for fitting larger rams (4 in. and 3¼ in.) in place of the existing 2½ in. diameter ram.

A simple cavitation tunnel had been constructed from existing equipment. This was of the free jet type with a working section approximately 1½ in. square and a maximum jet velocity of about 40 ft./sec.

Need to prevent leakage between moving surfaces is found in all branches of engineering, and it is a field in which there is no universal answer to all problems. To some extent the great diversity in current practice reflects the wide range of conditions that may be encountered in this subject, but it is also true that this diversity is much greater than the problem merits.

The association is at present testing various conventional types of rotary seal to determine their actual performance and while doing this, studying the fundamental processes involved. For this purpose three test rigs are available in which seals may be tested under conditions similar to those obtaining in industrial practice.

Regarding the stuffing-box seal, a large number of tests carried out on the greasy-hemp type of packing for sealing water have been described in research report 424. Such glands were unable to tolerate more than the slightest amount of shaft whip without leaking profusely, because the packings usually have little elasticity.

A device was now being tested which isolated the effect of whip in the shaft from the packing itself. This promised to be a successful solution to the particular problem of pumps with worn bearings.

Experiments with radial-face (mechanical) seals (research report 425) revealed that seals of unsuitable design may leak due to bouncing apart of the faces. The effect occurred above a particular speed, which depended on the inertia of the floating components and the spring-force holding the faces together.

It had also been established that with oil, the faces sealed on the upstream side of the interface and that no effective hydrostatic pressure existed between them.

The association comprises ordinary members, who are manufacturers or users of fluid machinery or equipment, and associate members, who are engineering consultants or academic workers. The affairs are managed by an elected council who appoint an executive committee and several research committees, on which all members may be represented.

Sources of Income

Expenditure at present is about £25,000 a year and the income is derived from members' subscriptions, from a proportionate Government grant and from individual grants for special investigations. Manufacturing members contribute 4s. per £100 of turnover on hydraulic equipment up to the first £200,000, with 1s. per £100 in excess. User members contribute according to their individual interests. Subscriptions rank for tax relief.

An important feature of the work of the association is to provide members with the latest known information relevant to their technical problems. So far the staff of the association has issued about 31 technical notes and research reports, 28 translations and 19 bi-monthly abstract bulletins.

Several hundred technical inquiries have been dealt with by the Library and Information Service, which have recently been expanded.

Australian Bauxite Deposits

Bauxite deposits discovered in Arnhem Land (Australia's Northern Territory) are the biggest known in the country, according to the Government geologist in charge of the Marchinbar Island bauxite project. The deposit has proved as good as anticipated and final prospecting work will be completed in another two months. The Marchinbar discovery should do away with the necessity of importing bauxite to feed the Australian Aluminium Commission's treatment plant at Bell Bay, Tasmania.

Society of Leather Trades Chemists

Two-Day Annual Conference Held at Leeds

THE annual general meeting and conference of the Society of Leather Trades' Chemists was held on Friday and Saturday, 19 and 20 September, at the University of Leeds, and presided over by Mr. G. Jessup Cutbush, president.

After extending a welcome to members and visitors on behalf of Professor D. Burton, Leather Industries Department, who was unavoidably absent, the president called upon Mr. J. Hill, M.Sc., to begin the session on Friday morning with his paper on 'A Shoeman's Views on Soling Materials.'

During the past quarter of a century, shoemaking methods had altered probably more than in all the previous history of the craft and were still altering, said Mr. Hill, so that in a few years' time, the vast majority of shoes would be made by what is called the 'stuck-on' process, rather than by nailing or sewing. Also the general speeding up of manufacturing processes had led to a greater standardisation of materials. It was largely because of these two facts that newer materials were taking the place of leather as a soling materials.

A discussion on 'The Intrinsic Properties which Make Leather so Unique,' followed.

Dr. R. W. Lunt opened the discussion by saying he would deal with properties necessary for one type of shoe, the Oxford Foot. Comfort was intimately connected with (a) thermal insulation, and (b) perspiration, and the dissipation of perspiration was most important. If there was no balance between dissipation and production of perspiration, dampness would result.

Unique Property

As the result of many observations, he had found that the generation of foot-perspiration amounted to about 2,500-3,000 mg. per hr., of which about 800 mg. was dissipated by adsorption by the sock and so on, 200 mg. by the pumping action, and 1,500-2,000 mg. by diffusion through the upper. This indicated that diffusion was the most important factor, in which connection, leather was unique.

In the opinion of Dr. H. Phillips leather was not so unique as it was sometimes thought to be, because it had characteristics most common to textile fibres, for example, hygroscopicity. Movement of the foot could disperse the water vapour, and the adsorbed moisture was lost by evaporation from the fibrous structure. A leather sole was therefore good, and as regards the impervious layer between out and insole, this might not be so impervious as many were inclined to think.

Dr. R. G. Mitton considered that the uniqueness of leather arose from the totality of all its properties, as well as from individual properties. One such property would be its extensibility and plasticity, where this property was good for actual shoe making and then gave place to elasticity. He had made tests which showed that shoes worn during a normal day did not dry back to original weight over night, and for full comfort the alternate use of two pairs of shoes was indicated. His own results showed too that the so-called pumping action had a very small effect indeed in the dissipation of perspiration.

Surface Films

To conclude the morning session a paper was given by Dr. S. C. Ellis and Dr. K. G. A. Pankhurst on 'Surface Films: A New Approach to the Mechanism of Tanning Reactions.'

Films of collagen one molecule thick, it was shown, could be formed on the surface of aqueous solutions by spreading from a dilute solution in formic acid. Surface pressure and potential measurements on these layers indicated that at areas greater than 1.8 m^2/mg. the protein existed in the surface with its side chains orientated parallel to the surface. Compression below this area forced the side chains into the vertical plane (at 1.3m^2/mg.), and then into the underlying liquid.

When spread on solutions of tanning materials, for example, mimosa, syntan and chrome, changes in surface pressure and potential were observed, which led to the view that with mimosa tannin the reaction took place mainly at the backbone of the protein by multiple-point association of the polyfunctional tannin molecules, whereas with the other tanning materials interaction

with the ionised groups of the side chains occurred.

It was observed that tanning of a protein monolayer was always accompanied by a rigification of the film, and a two-dimensional modification of the Couette viscometer had been designed to follow the progress of tanning reactions quantitatively.

Some preliminary work on simple substances related to vegetable tannins, showed that benzoquinone and catechin did not behave as tanning materials when pure, but developed tanning properties on being kept in solution.

Procter Memorial Lecture

Following the luncheon interval, the president introduced the Fifth Procter Memorial lecturer, Professor J. B. Speakman, D.Sc., F.R.I.C., who took for his subject, 'The Reactivity of Protein Fibres: Some Analogies between Keratin and Collagen.'

Professor Speakman began to develop his comparison of keratin and collagen in terms of the amino-acid composition. Because of the close similarity in the proportions of basic and (free) carboxylic acid side-chains, close similarity in the reactions with acids and alkalis was to be expected, apart from complications due to the presence of cystine in keratin.

Titration curves of the two proteins were compared and their reactions with acids discussed in detail. It was suggested that differences in the acid titration curves of different forms of collagen were due to neglect of differences in swelling, and to errors in the calculated amount of combined acid when no account was taken of the difference in concentration of acid inside and outside the collagen. In terms of the Donnan theory of membrane equilibrium, methods of calculating the 'true' titration curve were outlined, the 'true' curve representing the correct amounts of acid combined at different internal *p*H values.

Attention was next turned to the action of neutral salts on keratin, potassium chloride and lithium bromide being chosen as examples of two main types. It was shown that the former caused salt linkage breakdown through the association of potassium and chlorine ions with the oppositely charged ions of the linkage. Lithium bromide had the same effect but, in addition, caused hydrogen bond breakdown at concentrations below about 5.8 *M*. Above this concentration, co-ordination with hydrophilic groups in neighbouring chains led to some measure of cross-linking.

Close analogy between keratin and collagen was also found in the supercontraction of the former and the hydrothermal shrinkage of the latter. Although the molecular structure of keratin was more stable than that of collagen, because of cystine linkages in the former, hydrogen bond breakdown by means of a 50 per cent solution of phenol promoted the contraction of wool fibres at high temperatures. By determining the temperature at which 20 per cent contraction occurred in 20 minutes, in accordance with Zahn's procedure, it was shown that the least plastic wool fibres had greater cohesion than the most plastic.

In relation to tanning, it was shown that formaldehyde, benzoquinone and basic chromium acetate cross-linked keratin, and cross-linking reactions were to be expected with collagen. The fact that the strength of collagen was reduced by tanning was probably due to the effect of cross-linking on the extensibility and surface friction of the ultimate fibres. It was suggested that frictional measurements on tanned and untanned collagen fibres would be a profitable study.

Finally, some attention was given to the proportions of crystalline and amorphous material in protein fibres. A new method of measuring the proportions with heavy water was described, and it was suggested that the polymerisation of suitable monomers within the fibres, with subsequent cross-linking where possible, provided an interesting possibility of overcoming the accessibility problem and, at the same time, of developing new tanning processes.

New Officers Elected

The latter part of the afternoon was occupied with the annual general meeting of the society, at which formal business matters were dealt with. Mr. G. Forsyth was elected president for 1952-4, and Mr. G. J. Cutbush, the retiring president became vice-president. The new council consisted of Dr. A. Cheshire, Dr. J. R. Furlong, Dr. H. Phillips, Mr. J. M. Harrison, A.R.I.C., Mr. R. E. Hunnam and Mr. J. H. Sharphouse, B.Sc., Professor D. Burton (hon. treasurer), Mr. G. H. W. Humphreys (hon. secretary).

Before the annual dinner which was held in the University Refectory, a reception was held by invitation of the Yorkshire Dye-

ware and Chemical Co., Ltd., at the Metropole Hotel, Leeds.

On Saturday morning the session opened with a paper by Mr. W. I. Stephen, B.Sc., A.R.I.C., on 'Some Applications of Microchemistry.'

Recent advances in the science of microchemistry, said the speaker, had brought about marked changes in analytical techniques where only minute amounts of materials were available for analysis.

Although micro-chemistry had developed as an integral, discrete science involving synthetic as well as analytical processes, the latter were the most important and had the widest applications.

Water-soluble inorganic blooms or exudations often appearing on leather could readily be analysed by simple procedures. Thus, by dissolving the exuded substance in a drop of water, transferring the solution to a suitable micro-centrifuge cone, the conventional analysis could be effected. Only micro procedures would be suitable for such work as the normal procedures, involving either the ashing or digestion of sufficient material to carry out the analysis, would give the total inorganic content of the sample. This would be inconsistent with the analysis of the surface exudation.

Total inorganic content could, of course, be readily obtained by ashing about 5-10 mg. of the leather sample and after solution, the conventional group separations and tests applied.

The final paper of the conference was given by Professor D. Burton and Dr. R. Reed on 'Modern Views on the Architecture of the Collagen Fibrils in Pelt.'

Corium Structure

In an attempt to provide the tanner with a picture or model of pelt showing the architecture of the collagen fibrils, the structure of the corium was examined in the light of researches using some of the more modern techniques in biophysics and biochemistry.

A fresh hide was visualised as consisting mainly of fibres, unit fibrils and filaments of collagen. The electron microscope showed that the fibres vary in width, so the distance between them varied. They were not straight but were interwoven irregularly in three dimensions. They were built up from unit fibrils which were of uniform thickness and which were characteristically cross-striated. By various chemical treatments such unit fibrils could be degraded irreversibly into filaments. The importance of preventing this filamentation during the wet-work was emphasised. A fresh hide also included elastic tissue and reticulin fibres, which were bound together by interfibre materials, notably the mucoids.

It was not possible to make an accurate model of a piece of fresh hide because the fibres, the mucoid and other interfibre materials were distributed irregularly. They varied in amount even in a minute portion of the piece. So the various treatments in preparing the hide for tannage affected each minute portion to different extents.

Cause of Filamentation

Common salt had the virtue of preventing filamentation. Thus a properly salted hide or skin showed no degradation of the unit fibril. In soaking, the fibres should be split up into smaller fibres and unit fibrils, with some loss of interfibre binding material. Stale and alkaline soaks were liable to cause filamentation. The liming should carry the splitting of the fibres further and remove much of the interfibre material by causing rupture of the muco-protein links.

Bating completed the removal of the interfibre debris and removed any damaged fibrils, that is, those which had been shortened and frayed into filaments.

IMF Prize Awards

THE Council of the Institute of Metal Finishing announces that on the recommendation of the Publications Committee, the Westinghouse Brake & Signal Co., Ltd.'s prize is to be awarded to Mr. W. A. Marshall for his paper on 'Non-Electrolytic Smoothing Treatment for Steel.'

The prize will be formally awarded at the annual autumn meeting at the Grand Hotel, Birmingham, on Wednesday, 22 October.

After careful deliberation, the Council had come to the conclusion that no paper in the field covered by the terms of the Johnson Matthey Silver Medal Award had been received to warrant its being presented this year. It was hoped that papers would nevertheless be forthcoming on the subject matter within the purview of the award, to enable the medal to be presented next year.

Papers dealing with any aspect of electrodeposition of precious metals would be eligible for consideration.

Potentialities of Sorghum Stalks

Chemical Plant for Furfural Considered

CHEMICAL and paper-making properties of sorghum stalks are discussed by A. E. Chittenden, H. E. Coomber, B.Sc., and D. Morton in *Colonial Plants and Animal Products* (Vol. II, No. 4, October-December, 1951) the quarterly journal of the Colonial Products Advisory Bureau (Plant and Animal).

A sample of sorghum stalks was forwarded to the Colonial Products Advisory Bureau by the Director of Agriculture, Gold Coast, who stated that the sorghum or guinea corn was of the variety known as 'Peto,' which was extensively cultivated in the Northern Territory, Gold Coast.

Stalks 5 ft. Long

Of the three bundles of sorghum stalks comprising the sample, each was about 5 ft. long and 1½ ft. in diameter. The stalks, which were on the whole in sound condition, were generally of a dark straw colour with considerable mottled reddish-brown surface discoloration, and varied in diameter from ¼ in. to 1 in.

A representative portion of stalks was taken from the bundles, mixed and crushed between steel rollers; they were then cut into short lengths of 1-2 in. for paper-making trials. The chemical analysis was carried out on a portion of these small pieces ground to stand on a 72 mash B.S. sieve; the fines were rejected.

A chemical examination of the ground stalks yielded the following results, which are expressed on the moisture-free material:

	Per cent
Ash	3.4
Solubility in alcohol-benzene ('resin')	16.3
Alkali solubility (1 per cent NaOH for 1 hr. at 100°C.)	38.6
Cellulose	53.0
Pentosans	27.8
Furfural	16.3

Results showed that the stalks possessed a satisfactorily high cellulose content from the paper-making point of view, the 'resin' being rather high and the alkali solubility very high.

This limited investigation of the chemical and paper-making properties of sorghum stalks showed that:

(1) The material will produce a satisfactory yield of easily bleached, moderately strong, short-fibred pulp. Fairly severe conditions of cook are required and the chemical consumption is rather high and, moreover, the strength of these pulps was not increased to a very high level by beating. It appeared that, all things considered, bleached sorghum pulp could be utilised as a short-fibred filler for incorporation in longer-fibred paper furnishes.

(2) Although the α-cellulose content of a pulp is not the sole criterion as to its suitability for viscose manufacture, it was considered that with the low figure obtained in the present sample, the pulping of sorghum for artificial silk manufacture was unlikely to be economic.

(3) Since the pentosan content of sorghum stalks is relatively high, it was thought that the commercial production of furfural from this material might have economic possibilities. A leading firm of chemical manufacturers was consulted, and they stated that before any definite opinion could be given they would require the following information: (*a*) an accurate estimate of the quantity of sorghum stalks available; (*b*) whether there is a suitable central site where all the stalks could be collected for the preparation of furfural; (*c*) whether a chemical plant erected on the central site could be worked on an economic basis. In this connection, an adequate and cheap supply of fuel, water, etc., to produce reasonably cheap steam is one essential; (*d*) the cost and practicability of transporting the sorghum and chemicals to the site.

Economic Production Levels

The bureau was informed that a reasonable economic level of production would require roughly 50,000 tons of material yielding about 5,000 tons of furfural per annum. The cost of the raw material should not be more than £1 10s. to £2 per ton delivered at the plant.

In view of the relatively high pentosan content of the present sample of sorghum stalks, further consideration might be given to the possibility of using them for the commercial production of furfural.

Metallurgical Section

Published the first Saturday in the month

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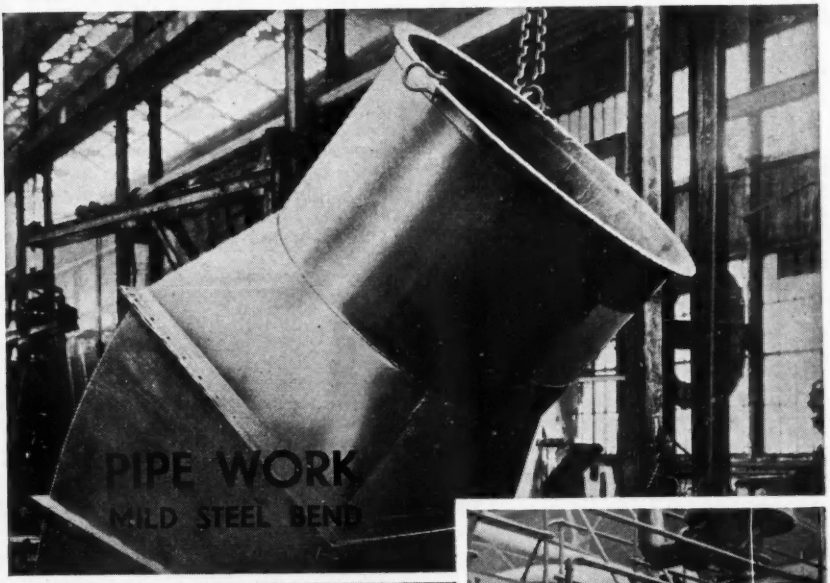

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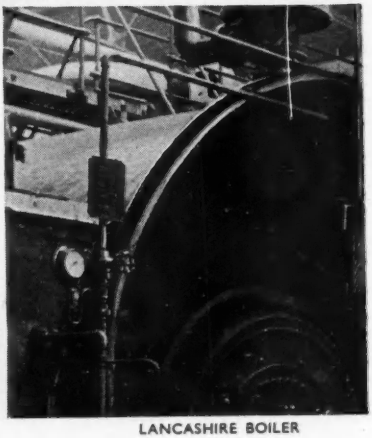

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Metallurgical Section

Zirconium Carbide Powder

Experiments in Hot Pressing

COMPOUNDS of the type known as interstitial carbides have very high melting points in the range 3,000-4,000° K., great hardness, electrical and thermal conductivities of the same order as metals, and they show a metallic lustre in the massive state. The latter properties, however, are not concomitant with ductility and plasticity, as they are with metals. At room temperatures the interstitial carbides are brittle and extremely hard.

Various attempts have been made to explain this combination of metallic and non-metallic properties. In 1930, G. Hägg proposed the interstitial theory, the basis of which is the idea that the metallic atoms are in actual contact and control the form of the lattice, while the smaller carbon atoms occupy the interstices in the metallic lattice. This is supported by X-ray structure determinations of the carbides, and also explains the importance of the radius ratio of the two atoms in deciding whether an interstitial carbide can be formed from a given metal and carbon. It does not account satisfactorily, however, for the great hardness and the brittle nature of the carbides, since the theory avoids the question of the nature of the bond between the metal and carbon, and offers no real explanation of the high conductivities. A more recent attempt to explain the constitution and atomic bonding in interstitial compounds in general has been made by R. E. Rundle (*Acta Crystallographica*, 180, 1948).

Cobalt as a Binding Agent

The great hardness of the interstitial carbides is made use of in tool tips which, for the most part, are alloys of tungsten carbide with or without titanium carbide and cobalt. The latter is present to the extent of 5-15 per cent and acts as a binder for the hard carbide particles. These tool tips are prepared by sintering a pressed compact of the appropriate powders at temperatures in the region of 1350-1550°C., when shrinkage occurs and a material consisting of hard carbide particles cemented with cobalt metal results.

Some experiments on the hot pressing of zirconium carbide powder at 2,000°C. are described by A. R. Hall and W. Watt in a report based on an R.A.E. Technical Note. This report is included in 'Ceramics and Glass,' which has recently been published by HMSO as Volume 10 of Selected Government Research Reports. (Price £1 5s. net).

Manufactured Metal Carbides

It was decided in these experiments to investigate the preparation and properties of materials formed from a carbide, or solid solution of carbides, in the absence of a bonding material. The manufacture of such materials presents problems associated with the high melting points of the carbides. The melting and casting of materials with melting points in the range 3,000-4,000° K. obviously presents considerable technical difficulties. These have been overcome in the case of tungsten carbide, but this compound has one of the lowest melting points of the interstitial carbides (3140° K.).

The sintering of uncemented carbides also presents considerable technical problems, the temperatures required being greater than 2,000°C., so that furnaces capable of operating at temperatures of this order for periods of several hours with provision for an inert atmosphere or high vacuum are certainly required. Recent attempts to sinter a mixture of titanium carbide and titanium nitride by heating for one hour at 2,000°C. in a vacuum of 2.5 microns Hg resulted in only partial sintering of the compact.

The electrical conductivity of the carbides has been applied in sintering experiments by passing a heavy current through the cold pressed compact so that it becomes heated by the resistance effect, the temperature attained being proportional to I^2R, where R is the resistance of the compact. The value

of R will decrease as sintering proceeds, due to the decrease of porosity. This method of heating has also been used for determining the melting points of the interstitial carbides.

During the last war another process for the preparation of dense bodies of carbides became prominent in Germany. It consists of the simultaneous application of heat and pressure to a mass of the powder contained in a graphite die. The die is commonly heated by the passage of a large electric current but an alternative method is eddy current heating, the die being placed in a coil through which an electric current of suitable power and frequency is flowing.

Eddy Current Heating

The process of eddy current heating was used in the preliminary investigation described by Hall and Watt, mainly on account of the availability of the necessary H. F. equipment in the department concerned. The compound chosen for the investigation was zirconium carbide, which was selected for various reasons. The melting point is high, the value quoted in the literature being 3805° K. ±125 deg. The density is of the same order as that of the heat-resisting metals, the extreme figures given in the literature being 6.20-6.90 gm./c.c. Another important point is that zirconium carbide is potentially cheap and is easily available, since zirconium is a widely distributed element in nature.

The zirconium carbide used in the investigation was obtained from commercial sources and had the following analysis (the values being percentages by weight):

Zirconium carbide	89.58
Zirconia	5.55
Titanium carbide	0.98
Iron carbide	1.29
Niobium carbide	0.13
Free carbon (graphite)	2.47
Nitrogen	0.02

This analysis seemed to indicate that the material had been prepared by the reduction of zirconium oxide with carbon according to the equation $ZrO_2 + 3C \rightarrow ZrC + 2CO$, but without the reaction being quite completed. This would account for the presence of the zirconia and the free carbon. 5.55 grams of zirconia requires 1.61 grams of carbon for conversion into the carbide, which would have left a final free carbon content of 0.86 per cent if the reaction had been completed. It is very possible that the residual zirconia was reduced to the carbide in the pressing operations described in the paper. The hot pressing operation should assist in completing the reaction because it brings the individual particles into better contact. This problem of good contact is one of the principal difficulties in reactions between two powders.

The zirconium carbide was a greyish-black powder and the particles were angular and roughly equiaxial when examined under the microscope. The powder was all less than 100-mesh sieve size and approximately 50 per cent was retained by a 200-mesh sieve. The density determined by the specific gravity bottle method was 6.22 gm./cc at 20°C.

Two powders prepared from this material were used. Powder B was obtained by grinding the original powder in a small ball mill to produce a material of particle size 84.1 per cent below 17.8 microns. Powder A consisted of 79 per cent by weight of 150-200-mesh powder separated from the material as received, plus 21 per cent by weight of powder B mixed by tumbling in a small ball mill. Powder A was made up to obtain a powder with a high packing density and a known amount of fines, the relative amounts being chosen from a consideration of the theoretical packing of two powders of different particle size.

Die Constituents

A graphitic material of density 1.68 gm./c.c. was used for making the die, which was turned out of a rod. The plunger was made from a hard carbon electrode of density 1.80 gm./c.c. The die was contained in an alumina cylinder, of 3 in. diameter by 6¼ in. high, the intervening space between the die and cylinder being filled with crushed magnesite brick, 10 to 30-mesh size, for thermal insulation. The coil was made from ¼ in. copper tubing and had 17 turns in a height of 5¾ in. It was water-cooled during operation, when it was connected to a 16 kW (maximum) spark gap H.F. heating set, made by E.F.C.O. A detailed description of the apparatus and experimental procedure is given in the report. Powder was applied to the coil according to a definite time-table and the pressing operation started at a fixed time from the moment of switching on the power. A heating schedule was worked out and adhered to in all pressing operations.

At the end of the required pressing time the power was switched off and the pressure on the plunger released. By working to a time-table in this way, it could be assumed that the temperature conditions for each pressing were identical. During the pressing operation the pressure was kept constant at the desired value by operating the controls of the press.

Experiments on measuring the temperature of the die were made on trial runs by sighting an optical pyrometer down a ¼ in. i.d. graphite tube of suitable construction. These measurements were unreliable because at temperatures over 1,600°C. the intensity of radiation observed was variable, indicating the presence of fumes inside the tube, and also because the tube frequently caved in before the end of a run. Accordingly a mock run was made with no plunger in the die but with the bottom plug and a length of graphite in the die of such a height that its top surface was at a height equal to half that of the die. An optical pyrometer was sighted vertically down on to this surface, the die was heated by the H.F. coil to a fixed schedule, and temperature measurements were made. These appeared to be satisfactory, since the field was of uniform intensity and did not fluctuate.

High Pressure Obtained

The duration of pressing was 15 minutes in all cases and pressures as high as 6.9 tons/sq. in. were obtained at 2,050°C. It was found that powder B could be pressed at 2050°C. to a density equal to 98.5 per cent of the original true density of the powder.

Powder A gave porous compacts on hot pressing at 2,050°C., at pressures up to 6.9 tons/sq. in. It is considered that this was due to the large particles setting up a structure and thereby preventing the fines from experiencing the full pressure. A mixture with a larger amount of fines to eliminate the possibility of the coarse grains setting up a structure would probably have given better pressed samples. Nevertheless, the results indicate a method of obtaining a carbide material with a controlled porosity, which might be desirable for certain applications.

Visually the compacts were black cylinders resembling a carbon material. The two hardest compacts had to be cut with a diamond slitting wheel. It was necessary to use a magnification of 2,000 to show the detail in these fine-grained samples. Photographs of the compacts after polishing but before etching showed that the coalescence of some of the grains was not yet perfect. It cannot be argued that the imperfections of the grain boundaries are due to preferential attack by the etching reagents, although some of the larger holes might be due to material dropping out in the polishing process. There is a possibility that some of the holes in the structure might be due to the formation of CO during the pressing operation, by reaction of the residual zirconia in the powder with the free carbon. The investigators are of the opinion that it would be well worth while to compare the pressing behaviour of this powder with a pure zirconium carbide powder. If the holes are not due to the escape of CO during pressing, they may be due to poor pressure distribution, which in turn would be due to the material not being sufficiently plastic at the pressing temperatures used. Pressing at higher temperatures might eliminate this.

There was no appreciable grain growth on hot pressing at 2,050°C. with either of the zirconium carbide powders used. No evidence of oxidation of the compacts during the pressing operations was observed either macroscopically or microscopically. This shows that the die develops its own protective atmosphere of CO during the heating, which protects the sample from oxidation. Provision of a vacuum during the pressing as a protection against oxidation therefore seems unnecessary.

African Aluminium Project

THE Gold Coast Government together with West African Aluminium, Ltd., and the Canadian Aluminium, Ltd., plan the establishment of a large aluminium plant in connection with the £100,000,000 Volta River scheme. The Government will guarantee that the factory will not be nationalised. Aluminium, Ltd., and perhaps the British Aluminium Company will finance and construct facilities for mining bauxite, reducing it to alumina and from thence to primary aluminium. Large reserves of good bauxite are about 200 miles away from the power site. The power location has an estimated kilowatt production for 210,000 metric tons of primary aluminium annually.

Iron & Steelmaking Course

Students Spend Week at United Steel

AT the invitation of The United Steel Companies, Limited, 36 students of pure science, engineering and metallurgy, from the universities of London, Sheffield, Leeds, Southampton, Cambridge, Bristol and Birmingham spent a week in Sheffield as guests of the company from 22-27 September.

The aim of the course was to give an insight into the scientific foundation of iron and steelmaking and of certain derivative chemical manufacturing processes, and the scope of engineering and research in the industry. Some idea, too, has been given of the economic structure of the industry. An indication was, therefore, given to the undergraduates of the opportunities available within the steel industry and it is hoped that it will benefit those who attended and will assist them in deciding the sort of career they would like to follow when coming down from their universities.

The undergraduates were in residence at University Hall, Sheffield, under the supervision of Mr. T. Fletcher, T.D., Company Training Supervisor, who was in residence with them during the course.

The guests arrived in time for dinner on Monday, 22 September, and were welcomed by Mr. F. H. Saniter, Director of Research, and by Mr. D. R. O. Thomas, Chief Education Officer. During their week's visit they studied the work of a fully integrated iron and steel plant at Appleby-Frodingham Steel Company, Scunthorpe (Tuesday); visited the company's new Research and Development Department at Swinden Laboratories, Rotherham on Wednesday; observed the manufacture of alloy steels and finishing processes such as fine wire, stainless steel and cold rolled precision strip at Samuel Fox and Company Limited, Stocksbridge (Thursday), and visited the works of Steel, Peech & Tozer, Rotherham, and The United Coke & Chemicals Company Limited, Treeton (Friday).

The undergraduates were entertained to dinner each evening at University Hall where they met representatives of the Board, Management and Head Office staff and had the opportunity of discussing points of detail with them. After dinner the day closed with a talk on some aspect of the steel industry, or a brains trust or a general discussion.

New Metal Recovery Company

TO reclaim components and metal products from corroded conditions, a new enterprise —the Recovery & Protective Company— has been launched by a metallurgical chemist and a service engineer in partnership.

In order to launch the company, the chemist, Mr. E. Middlehurst, resigned his position as chief chemist of Jenolite, Ltd., makers of industrial chemicals and experts in pre-treatment and anti-corrosion processes. His experience in corrosion convinced him that there is a need in Britain for a service that will reclaim corroded components. The initial equipment and factory capacity at 10 Ver Road, St. Albans, is calculated to handle such equipment as drums, unit containers, fire extinguishers, casings, pressure cylinders, hand tools, motor car parts and spares, canteen equipment, mechanical units and vehicles.

The plans of the company are not confined to reclamation. An advanced form of metal pre-treatment has been developed which has been proved to extend the service life, the sales appeal and the corrosion-resisting qualities, both in service and during storage and transit, of wide ranges of new units.

Mechanical reclamation, often necessary in the course of reclaiming from corrosion, is directed and supervised by Mr. Middlehurst's partner, Mr. C. Andrews, who was for many years service engineer to one of the largest groups of diesel engine manufacturers in the country. He is a specialist in mechanical engineering.

This young company has already been commended by a contractor for achieving satisfactory results in reclamation of pressure cylinders which other methods had failed to solve.

Norwegian Copper Pyrites

Production at the rate of 150,000 tons of copper pyrites a year will start at the Skorovas mines in North Norway later this month. The mines will employ 170 men. The Norwegian Government guaranteed a loan of £650,000 for the reconstruction of the mines. It is expected that nearly the whole output will be exported. Norway's production of pyrites last year was 700,000 tons, and the Skorovas mines will help to raise total production nearer the 1,000,000 tons which was the annual rate pre-war.

New Swedish Alloy

BUILT up on the basis of molybdenum, a new powder-metallurgical product has been developed by AB Kanthal of Hallstahammar, after many years of intensive research, which is capable of withstanding temperatures up to 1,600° to 1,700°C. It is expected to be of far-reaching importance in the design of high-temperature furnaces, its primary uses being intended for laboratory equipment, the firing of ceramic products and for dental furnaces.

To be put on the market towards the end of the year, this molybdenum alloy is the latest of a series of high-temperature electrical resistance alloys already manufactured by this firm. These are chromium-aluminium-cobalt-iron and are claimed to be superior to chromium-nickel inasmuch as they can withstand temperatures up to 1,350° C. compared with a maximum of 1,150°C. for chromium-nickel. Their characteristics include a high resistance to oxidation and a thin and tough strongly adhesive and very heat-resistant oxide skin, which enables the metal to be used repeatedly over a long period at very high temperatures. It has good welding and shaping properties, is sulphur-resistant and of homogenous structure.

As well as being used for melting, firing and forging at very high temperatures these alloys are also used at about 500°C. for heating the air for chemical processes.

Indian Manganese

Battery & Metallurgical Grades Specified

THE Indian Standards Institution has issued two specifications for manganese ore, one for battery grade and the other for metallurgical grade.

For many years past, India has been one of the largest suppliers of metallurgical manganese ore in the world, but the buying and selling of this commodity have never been regulated by any hard and fast standards. Manganese ore of the battery grade, on the other hand, has been exported in the past in relatively small quantities. As a result, however, of researches and accumulated manufacturing experience gained by the industry, Indian ores are finding a definite market for use in the battery manufacturing industry abroad (an official statement states). At the same time, manufacturers of dry cells in India are also making progressively greater use of Indian ores, though foreign ores are still being imported.

In view of the necessity for ensuring a fair amount of uniformity in marketing different qualities, and to be in a position to offer these qualities to the world trade, it has been considered desirable to issue these standards. It is also expected that their use would promote increased utilisation of manganese ore in indigenous industries.

The standard for the battery grade covers ore of high manganese dioxide content, sometimes referred to as peroxide ore or chemical grade ore, suitable for use in the manufacture of Leclanché type cells and batteries, and also certain chemicals and pigments. The standard refers particularly to ores of Indian origin, but this does not preclude its use in connection with ores of other origins.

The other standard for the metallurgical grade covers ore suitable for metallurgical uses, such as manufacture of ferro-manganese, manganese alloys, manganese metal, etc.

Both standards carry two appendices, one on sampling and the other on chemical analysis of manganese ore of the grade concerned.

More Steel Produced

PRODUCTION of steel during the first half of this year was 260,000 tons less than during the first six months of 1951. Latest output figures show that this decline has now been made good. Despite the effect of the holiday period production in July was equivalent to 14,236,000 tons a year (13,317,700) and in August 14,535,000 tons a year (13,855,000). As a result the average annual rate for the eight months of this year at 15,630,000 tons shows an improvement of 4,000 tons over the average for the same period of 1951.

An output of 16,000,000 tons for the year is confidently expected by the steel industry unless unexpected difficulties arise over supplies of materials. This achievement is still dependent on a further expansion of the production of pig iron, if the withdrawals from stock made last year are to be replaced. A progressive rate of improvement has been maintained in output of pig-iron during the first six months of this year, being at an annual rate of 10,397,000 tons (9,506,000).

Phosphate Coatings On Steel

A MEETING organised by the Iron and Steel Institute in conjunction with the British Iron and Steel Research Association to discuss papers on the corrosion of steel under phosphate coatings and protective finishes will be held at 2.0 p.m. on Tuesday 28 October, at 4 Grosvenor Gardens, London, S.W.1. Mr. H. T. Shirley, chairman of the Corrosion Committee, BISRA will preside.

The following papers (which have already been published in the *Journal* of the Iron and Steel Institute) will be discussed:—

'Phosphate Coatings as a Basis for Painting Steel,' by the Phosphate Coatings (Drafting) Panel of the British Standards Institution. To be presented by Dr. J. C. Hudson, chairman of the panel.

'Corrosion by Retained Treatment Chemicals on Phosphated Steel Surfaces,' by S. G. Clarke and E. E. Longhurst.

'Tentative Analytical Tests for Phosphate Coatings on Steel,' by R. St. J. Preston, R. H. Settle and J. B. L. Worthington.

These three papers will be discussed jointly.

Second Report of the Methods of Testing (Corrosion) Sub-Committee. To be presented by the chairman of the sub-committee, Dr. J. C. Hudson.

A few reprints of the papers are available at 1s. each for the paper by Preston, Settle and Worthington, and 5s. each for the other three.

The meeting will be open to all interested. There will be no charge for admission, but tickets will be required, and these may be obtained on application to the secretary of the Iron and Steel Institute.

New Source of Titanium

Ilmenite in Florida Back Sands

THE titanium-bearing iron ore, ilmenite, is now being dredged in sizeable quantities from Florida black sand, according to a recent U.S. report. This sand is similar in every respect to the 15-mile black sand beach in Travancore, India, from which ilmenite has been obtained for some years past, and is the result of erosion and upheavals in the geologic past. The Florida project is interesting because the method of dredging is creating a travelling lake in the area adjoining Camp Blanding, where the Humphreys Gold Corporation of Denver, Colorado, is carrying on operations for the Du Pont interests.

A 20-in. suction tube draws the sand into a barge which moves along steadily as it works, and from which the sand can be dumped back as soon as separation of the ore is accomplished, thus saving tremendous sums in transporting bulky soil and disposing of waste materials. The ore is then further treated in a 'dry mill' nearby where electro-magnetic and electrostatic processes concentrate it for shipment to the mills at Baltimore and Edge Moor, Delaware, which handle it at a rate of 100,000 tons a year. This is a great improvement over the methods used in India, where native workers gather sand in hand baskets and carry it to mill in small boats, after which the concentrate is transported to ocean freighters by primitive vessels of limited capacity. Ilmenite is also found in Norway, in New York State, North Carolina and Virginia.

The Kennecott Copper Corporation is also working a Canadian area which may prove to be the world's largest source of titanium ore. In recent times some iron ore deposits used to be neglected because of the presence of 'impurities'. These have since proved to be ilmenite and some of the deposits are now being worked for the titanium alone, with iron as a by-product.

U.S.A. Relax Metal Controls

Allocation controls on the use of pure tungsten and pure molybdenum were dispensed with recently by the National Production Authority of the U.S.A. as both materials are now in adequate supply to meet requirements. The amendment does not apply to ferro-tungsten or other similar forms of molybdenum, such as ferro-molybdenum and the oxide.

New Thallium Recovery Method

New methods for the recovery of thallium are reported to have been developed by the U.S. Board of Mines. One process utilises volatilisation for recovery of the element from white arsenic and the other cyclic leaching for its recovery from lead smelter flue dust. Ordinarily thallium is found in such small quantities that it can be recovered only as a by-product in processing ores of other metals.

The Chemist's Bookshelf

MODERN CHEMICAL PROCESSES. Volume 2. Reinhold Publishing Corporation, New York. 1952. Pp. 299. Price 40s.

When the first volume of this series appeared in 1950 I was unenthusiastic, previous experience having made me sceptical. I was already familiar, as so many other chemists must be, with those long and impressive articles upon chemical engineering topics, complete with graphs and tables; but alas, lacking those few vital pieces of information which are needed for design or operation. Now after two years in which I have had constant reference to the book I can revise my opinion and excuse myself by observing that this type of book is not one which is attractive upon first reading; but, like an anthology, it improves with familiarity.

With the publication of Volume 2, it is becoming obvious that this series will provide a very valuable reservoir of information upon chemical technology. In making this claim, however, I must retain my original reservation that much of the material refers directly to American processes, conditions and plants, and will, therefore, be of interest mainly to the advanced student and the designer. In the present volume, however, it is pleasant to note that the articles which are exclusively of American interest are restricted to three, two of which are concerned with sulphur mining and recovery from natural gas.

The reviewer of the encyclopaedic type of book is always at a considerable disadvantage because so many fields are covered. The only way to assess a book with a team of authors is to have a team of reviewers. This, unfortunately, would be an unwieldy and protracted process, so, as with Volume 1, I shall leave the criticism of the chapters dealing with Brewing, Winemaking, Edible Oils, Cane Sugar Refining, Food Yeast from Sulphite Liquor, and the three chapters upon wood pulp and paper making to reviewers more closely acquainted with these highly specialised topics.

Of those remaining, several deal with the moderate scale manufacturing plant. Each chapter begins with a historical account, which, while it does not go into elaborate detail, supplies enough basic information to give the reader a perspective. It is interesting, for instance, to read that Dowtherm arose in the first place as an unwanted by-product in the Dow process for making phenol, its use as a heat transfer material being discovered much later. The section dealing with economic considerations is one which will bear only obliquely upon British methods, but frequently can be used in a comparative fashion. Thus in the production of the dye developer phloroglucinol from trinitrotoluene the economic possibility of the process was influenced by the availability of war surplus TNT, and the comparative scarcity of alternative developers. It is possible that this process was only rendered feasible by the exceptional conditions prevailing in the United States directly after the war.

The treatment of the material dealing directly with the plant and its operation varies from article to article, and in some cases is exhaustive. The texts are illustrated with very clear flow sheets and some very indifferent photographs. At the end of each chapter there is a section which deals with related compounds and chemistry of the substance treated, and, in some cases, useful lists of properties. A bibliography and equipment manufacturers list complete the text.

One of the more instructive topics is that describing the development of glyoxal production. At first this chemical had very few direct uses, but its availability on the American market at a reasonable price encouraged and continues to encourage manufacturers to find new uses for it. This type of production where the chemical precedes the demand for it is not overpopular in this country, and the inherent risk involved has tended to make it the prerogative of the large and prosperous company. The present

book leaves us in no doubt that successful gambles can be very rewarding.

The account of the newer inorganic chemicals containing lithium concludes by giving a report on the manufacturer's future plans for expansion and improvement. In order that the material in the series should not become out of date I would suggest that each volume should contain a short appendix bringing one of the subjects described in an earlier volume up to date when such a process becomes necessary.—J.R.M.

PSYCHOLOGY IN INDUSTRY. By J. Stanley Gray. McGraw-Hill Publishing Co., Ltd., New York and London. First Edition. 1952. Pp. 401. 42s. 6d.

Industrial psychology is a comparatively new field (on this side of the Atlantic at least), and it is undoubtedly one in which great progress can be expected in coming years. The Americans have applied this social science far more extensively and far more effectively than we have in Britain and it is sometimes said that a contributing factor to the greater productivity of the U.S.A. is their ability to get the best out of the worker. Undoubtedly the average American worker has a better morale than his British counterpart and the progressive American employer does know how to put each employee to the best possible use. Professor Gray's book is, therefore, of especial interest as he is well-known in America as a scholar, research worker and teacher.

Although 'Psychology in Industry' is an introduction to industrial psychology and is intended as a university textbook, it can be useful to anyone who has an elementary knowledge of general psychology and industry. The personnel officer of good education, for instance, is sure to find it of interest and value. Indeed, it would do most production managers a world of good to read through it even if some portions were too technical to be fully understood. As a matter of fact, however, the book is factual rather than theoretical and elementary technical knowledge is essential for only a limited part.

In his preface Professor Gray explains that the book deals with those factors which affect workmen and the efficiency of their productive efforts. The author believes 'that any factor which affects production efforts is appropriately classified as industrial psychology and anything that is known about it should be reported in a textbook on the subject.' It is obvious, therefore, that a wide field of topics will be discussed and this proves to be the case.

The introductory chapter deals with some of the basic facts necessary for an understanding of industrial psychology—the nature of the work curve, the measurement of work, the nature of fatigue, and the efficiency of work. The next two chapters are on Work Analysis and Worker Analysis. Other chapters discuss Job Training, Methods of Work, Wages and Merit Rating, Wages and Job Evaluation, Nutrition and Rest, Safety, Monotony and Boredom, Lighting and Ventilation, Age of Workers, The Worker's Morale, and Employee Adjustment. A brief appendix gives some basic statistical concepts. Typical research is reviewed throughout each chapter and implications are suggested relative to each factor.

In one of the early chapters the author states: 'the typical industrialist is a much better manager of machines than he is of men. One reason is that he knows machines better than he knows men. He can read and understand books about machines more easily than he can read and understand books about workmen. . . . Human engineering or industrial psychology has been neglected in typical American industry." If this is so in America it is certainly so in Britain and the wide-spread reading of Professor Gray's book will do no harm.—A.R.

National Smoke Abatement Society

The Annual Conference of the National Smoke Abatement Society took place in Portsmouth from 24-26 September. The Presidential Address was given by Alderman Professor F. E. Tylecote, M.D., who surveyed the pioneers of the movement. Papers read at the conference included 'Smoke and the Law'—the 3rd Des Voeux Memorial Lecture, read by W. R. Hornby Steer, M.A., LL.B., F.R.San.I., and 'Air Pollution and Cancer of the Lung' by Dr. Percy Stocks, Senior Research Fellow of the British Empire Cancer Campaign. The work of the Fuel Research Station of the DSIR was outlined in a report by Dr. E. T. Wilkins, Superintendent of Observations, Atmospheric Pollution Research, and Dr. J. L. Burn, Medical Officer of Health for Salford, spoke on smokeless zones.

HOME

Chemical Society

As from 1 October, 1952 the Chemical Society's telephone numbers will be Regent 0675/6.

Prices Reviewed Further

National Titanium Pigments, Ltd. have had reason to review further the selling price of their 'Runa' Rutile Type Titanium Oxide Grade R.G. and, as a result, retrospective as from 1 September, the increase in price of this grade will be only £1 per ton, as against the £7 per ton advised in our issue of 6 September. It is proposed to make no change in present selling prices for full strength anatase and reduced grades of pigment.

Metal Controls Eased

The Minister of Supply, Mr. Duncan Sandys, has announced further relaxations in metal controls. As from 1 October licences are no longer required for the acquisition and use of lead, lead alloys, lead scrap and residues, remelted zinc, zinc alloys, zinc scrap and residues, copper scrap and residues, and copper alloy scrap and residues. Licences will still be required for the acquisition of unwrought copper and virgin zinc, and copper and zinc ores and concentrates. The restrictions on the use of copper and copper alloys in the manufacture of certain articles remain in force.

Plant for Oil State

Messrs. G. and J. Weir, Ltd., Holm Foundry, Cathcart, Glasgow, have received an order to supply sea water distillation plant capable of providing 1,000,000 gallons of fresh water daily for Kuwait. Work on the order is to commence and delivery is scheduled to start in mid-1954 and to be completed by the end of 1955. The order has been placed by Ewbank & Partners, Ltd., the London consulting engineers, on behalf of the Sheikh of Kuwait, and installation of the plant at Shuwaikh is part of his programme of modernisation of the public facilities of the State. The fresh water will be for local domestic use. The programme arises out of the rapid expansion of the oil industry in Kuwait.

I.P.S. Prices Down

Shell Chemicals, Ltd. have reduced their prices for Shell I.P.S.1 and Shell I.P.S.2 as from 24 September. The new prices, ranging from 6s. 3d. per gallon for I.P.S.1 and 5s. 7d. for I.P.S.2 in small lots, to 5s. 3½d. and 4s. 7½d. respectively for bulk quantities, are very attractive for low boiling alcohol solvents.

Pharmaceutical Engineering

At the first meeting of the new session of the Evans Scientific Society held in Liverpool on 19 September, Mr. David Train, M.C., B.Pharm., B.Sc.(Eng.), A.R.I.C., A.C.G.I., Ph.C., lecturer in Pharmaceutical Engineering Science, School of Pharmacy, University of London, gave a lecture on 'Pharmaceutical Engineering in Pharmacy and Industry.'

Office-Holders Elected

The Fertiliser Manufacturers' Association and the Superphosphate Manufacturers' Association announce the following appointments of office-holders, which take effect from the dates shown:—Fertiliser Manufacturers' Association: president, Mr. A. E. Sell (25 September); vice president: Mr. James Gray (25 September). Superphosphate Manufacturers' Association: chairman, Mr. R. B. Risk (9 September); vice chairman, Mr. J. W. Napier (9 September).

Off on Tour of U.S.A.

At the invitation of Massachusetts Institute of Technology, Professor E. R. Jones, Professor of Organic Chemistry at Manchester University, left Liverpool on 23 September for a three-month tour during which he will lecture to university graduates at Massachusetts on the result of research work at Manchester University on vitamin A and cortisone. Before he sailed Professor Jones said he was the first to be invited under a scheme sponsored by the Arthur D. Little professorship of chemistry in Massachusetts Institute of Technology. 'I really feel it an honour' he said, 'and I think it is on account of the work I have been doing for the last 10 years on acetylene chemistry.'

OVERSEAS

Now Independent

As a result of increased local production of diphenylamine (DPA), which Australia formerly imported for use as a specific against internal parasites which attack livestock, I.C.I. has now made the country independent of overseas supplies. When the Korean War broke out supplies became restricted and, in consequence, were rationed. A new plant at Botany, New South Wales, and an existing one at Melbourne, Victoria, now produce adequately for the country and leave a small surplus for export to New Zealand.

Celanese Development

The new chemical plant being erected on the outskirts of Edmonton by the Celanese Corporation of America and costing $55,000,000 was said by the president, Harold Blanke, to be 'just initial expenditure' on the project. Ultimate plans could not be revealed at present, but extensive additional research was being carried out which would lead to increased development in the chemical and associated industries.

Uranium in Australia

An agreement whereby Consolidated Zinc Proprietary, Ltd. (a wholly-owned subsidiary of The Consolidated Zinc Corporation of London) is to develop rapidly the Rum Jungle uranium deposits on behalf of the Commonwealth was announced on 11 September by Mr. Howard Beale, Australian Supply Minister. An organisation is being considered by the Government to control the whole development of the uranium resources of Australia.

Atom Plant in Ohio

Recently announced by the Atomic Energy Commission, U.S.A., are plans for the erection of a gaseous diffusion plant in Pike County, Ohio. This, it is estimated, will cost $1,200,000,000 and will take four years to build. It will produce uranium 235 and will need 1,800,000 kilowatts of power when in full operation. New power plants will be built to provide this, existing facilities being used for early operations up to 400,000 kilowatts.

Appreciation of Canadian Research

A tribute to Dr. E. W. I. Steacie, president of the National Research Council, and Professor D. J. Le Roy, of the department of chemistry, University of Toronto, for their work in research on free radicals, was paid by Sir Charles Goodeve, president of the Faraday Society at its meeting in Toronto recently. This was the first time in its history that a meeting of the society has been held outside Britain.

Soaring Iraqi Oil Production

A new record output of 1,560,413 tons of crude oil in August at its Kirkuk field, compared with 1,151,274 tons in July, is announced by the Iraq Petroleum Company and its associated companies. The August production is equal to an annual rate of nearly 19,000,000 tons, which is not far short of the target rate for Kirkuk of 22,000,000 tons a year. The Basrah Petroleum Company at the Zubair field produced 194,372 tons in August compared with 183,461 tons in July, while the Petroleum Development (Quatar), Ltd., increased its output from 272,061 tons in July to 274,110 tons in August.

Brazilian Manganese Plan

A plan drawn up by the Government for the development of the manganese reserves at Urucum, Mato Grosso, by a Brazilian group in conjunction with the U.S. Steel Corporation has been approved, and U.S. $30,000,000 will be spent for the purchase of equipment and machinery for the extraction of ore from the Urucum deposits, which have been estimated at over 30,000,000 tons.

Spanish Import Syndicate

Importers of nitrogenous fertilisers have formed a group known as the Agrupacion Sindical de Importadores de Abonos Nitrogenados, which will handle all imports. The aggregate guarantee is limited to 200,000,000 pesetas (£1,750,000). Annual imports of nitrogenous fertilisers in recent years have been about 70,000 tons. The import of 10,000 tons from France was the first under the new scheme.

· PERSONAL ·

The Clayton Aniline Co., Ltd., announce that MR. H. YEOMAN, commercial manager, will retire from active management on 31 October and will be succeeded by MR. G. H. CARNALL.

Mr. Yeoman's knowledge and long experience of the trade will continue to be available to the company in a consultative capacity.

MR. J. L. ARMSTRONG, treasurer of Imperial Chemical Industries, has been appointed finance director of the company, and MR. P. K. STANDRING, chairman of the Dyestuffs Division, has been appointed director in charge of the Dyestuffs and Pharmaceutical Group.

SIR GEORGE THOMSON has been appointed a member of the Scientific Advisory Council which was set up in 1948 to advise the Minister of Fuel and Power on the scientific aspect of his statutory duties. Sir George is late Professor of Physics at the Imperial College of Science and Technology and has recently been appointed Master of Corpus Christi College, Cambridge. Sir Charles Goodeve, due to other commitments, and Professor Zuckerman, whose term of office has expired, have ceased to serve on the Council.

Monsanto Chemicals, Ltd., have announced that MR. W. MORGAN THOMPSON has been appointed deputy general manager of sales with effect from 1 October. Mr. Morgan Thompson joined the company in 1933 and was appointed manager of the fine chemicals section of the sales division on his return from war service in 1945. After successive appointments as home sales manager and sales manager he became sales controller in 1950.

Mr. Morgan Thompson, who has wide commercial experience in the chemical and and pharmaceutical industries, both at home and abroad, is a member of the Pharmaceutical Society and of the Council of the Association of the British Pharmaceutical Industry.

Concurrently with this appointment, and in order to complete the re-alignment of the sales division, MR. D. C. M. SALT is appointed manager of the general chemicals sales department, and MR. J. S. HUNTER of the technical chemicals sales department.

Mr. Salt will be responsible for general chemicals home and export sales groups, and the plastics and agricultural chemicals sales groups. Mr. Hunter will be responsible for the oil additives, rubber, textile and silicon chemicals and development sales groups.

MAJOR F. MONK, O.B.E., M.C., Dunlop's chief safety officer in this country, has retired at the age of 65. He joined Dunlop in 1918 as boys' welfare supervisor and was labour and welfare manager when appointed to his present post in 1949.

At a meeting of the Council of the National Sulphuric Acid Association held on 19 September, SIR DANIEL FENNELLY, C.B. was appointed general manager as from 4 September, 1952. Sir Daniel Fennelly previously held an appointment in the Civil Service as Under Secretary to the Ministry of Materials, from which he retired on 30 June, 1952.

MR. S. C. TYRRELL, F.C.W.A., F.I.I.A., chief accountant and local board director of Newton Chambers & Co., Ltd., the Yorkshire ironfounders, engineers and chemical manufacturers, and president of the Institution of Cost and Works Accountants, has received the Gold Medal of Honour of the Industrial Society of the Province de l'Est. The membership of the Society making the award comprises the senior executives of most of the heavy industries and other leading engineering concerns in France.

The appointment of N. GRECCO as operating superintendent in charge of Chemicals, Resins and Material Handling for Monsanto Canada, Ltd., Montreal plant, has been announced in Montreal by A. MONSAROFF, vice-president and production manager. Mr. Grecco, whose appointment is effective 1 October joined Monsanto Canada, Ltd., in April, 1950. He is a native of Thorold, Ontario, and received a degree in Chemical Engineering from McGill University in 1950.

Publications & Announcements

ELECTRODES designed especially for welding mild steel and medium high tensile steels are described in its leaflet T.C.858 now issued by Quasi-Arc Co., Ltd., of Bilston, Staffordshire, which summarises the characteristics, properties, and welding procedure of its Low Hydrogen 35 Electrodes. The qualities of these electrodes enable the welding of many types of carbon and alloy steels to be carried out without fear of junction zone or weld metal cracking, which formerly could only be welded by using austenitic electrodes. A chemical analysis of the weld metal produced by the Low Hydrogen 35 electrodes gives the following percentages: carbon 0.06; manganese 1.05; silicon 0.50; sulphur 0.025; phosphorus 0.030. These electrodes are suitable for welding fabrications to be used at low temperatures because of the high notch toughness of the weld metal at sub-zero temperatures. They are also suitable for fabrications to be glass-lined or glaze enamelled because no appreciable quantity of gas is evolved from the clean and almost hydrogen-free weld metal during the firing operations.

* * *

A DRAWING appliance of interest to all who have to undertake scale drawing quickly and accurately is the 'Quickdraw' technical drawing device. This consists of a strong folder 14 in. square, containing a light but rigid board which acts as a drawing board. Attached to this base is a unit consisting of a transparent template fastened to a toggle hinge by strong metal eyelets which prevent slackness, the whole forming a pantograph. The template, which is of transparent plastic, is cut accurately so as to reproduce the principal angles, as well as triangles and rectangles, either in inches or millimetres, to scale, circles from $\frac{1}{8}$-1 in. dia. or sections thereof, and hatching by means of nine pencil point holes and the use of a ruler. Total weight of the instrument including folder is only 2 lb., and the maximum paper size it can take is 10 by 13 in. It enables the production of drawings and sketches with a minimum of effort by anyone, with or without experience, and without all the cumbersome paraphernalia of the drawing office. In addition, for the specialised user the central rectangular space in the template may be filled by a separate plate containing various shapes and symbols as required. Some of these are stocked by the company, and others can be cut to order. The firm marketing this ingenious device, which is patented, is the Quickdraw Company, 127 Gunnersbury Avenue, London, W.3.

* * *

TRANSFERENCE of liquid from one container to another at any speed is easily achieved by the 'Langfilcon' a new machine details of which are given in a leaflet obtainable from Lang-London, Ltd. British made throughout, the 'Langfilcon' has been primarily designed to operate in the production unit itself, that is, mixing machine, process tank, or storage vessel. Any sediment is automatically incorporated and the contents of one vessel can be transferred into another with a minimum of aeration. By use of the multi-discharge head transfer can be made to a batch of containers simultaneously. Effective cleaning can be performed by working the unit for a minute or two in water or a suitable solvent. The machine can thus be switched from colour to colour, or from one product to another with little delay.

* * *

RECENTLY published is National Building Studies Research Paper No. 14, 'Reactions between Aggregates and Cement. Part 1. Alkali-Aggregate Interaction: General.' This is the first of a series of papers which will deal with alkali-aggregate problems, and describes the early investigations in the United States and the theories on the subject. There are various chemical reactions which can be the cause of breakdown in concrete structures, one of the most important being that of siliceous aggregates with the sodium and potassium hydroxides released during the hydration of cement. The alkali silicate gel formed in this way can swell sufficiently to crack the concrete. The mechanism of expansive pressure is not yet fully understood; current theories on the subject are briefly described in the paper, which deals with observations made on concrete dams, bridges and buildings in the U.S.A. and with tests on the types of reactive aggregates used in their construction. Test methods are described and recommendations for the prevention of expansion due to chemical reactions are given.

Next Week's Events

MONDAY 6 OCTOBER

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. Joint meeting with the London & South-Eastern Counties Section, RIC. Chairman's address: Dr. H. K. Cameron: 'The Chemist in the Electrical Industry.'

TUESDAY 7 OCTOBER

Society of Chemical Industry

Belfast: Agricultural lecture theatre, Queen's University, 7.15 p.m. Northern Ireland Section, joint meeting with the Chemical Society and the RIC. A. J. Howard: 'The Winning and Utilisation of Peat.'

London: Burlington House, Piccadilly, W.1, 5.30 p.m. Joint meeting of the Agriculture and the Oils and Fats Groups. Dr. F. B. Shorland, of New Zealand: 'New Zealand Researches on Animal Fats.'

Hull Chemical & Engineering Society

Hull: Church Institute, Albion Street, 7.30 p.m. Dr. C. L. Cutting: 'Some Chemical and Engineering Problems of the Fishing Industry.'

Institution of Chemical Engineers

Cardiff: University College of South Wales and Monmouth, Cathays Park, 7 p.m. South Wales Centre, Graduates' and Students' Section. N. Monks: 'Non-metallic Corrosion-Resistant Materials.'

Incorporated Plant Engineers

Cardiff: South Wales Institute of Engineers, Park Place, 7.15 p.m. 'Plant Inspection as an Aid to Maintenance.'

London: Royal Society of Arts, John Adam Street, Adelphi, W.C.2. G. W. Underdown: 'Fire Protection in Factories and Works.'

WEDNESDAY 8 OCTOBER

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. Corrosion Group. Discussion on 'Filiform Corrosion and Related Phenomena.' Speakers: R. J. Brown, F. Hargreaves, J. F. Kayser, and Dr. C. F. Sharman.

Incorporated Plant Engineers

Nottingham: Welbeck Hotel, 7 p.m. East Midlands Branch. J. C. Elliott: Protecting Your Plant from Fire.'

Association of British Chemical Manufacturers

London: Grosvenor House, Park Lane, W.1, 7 p.m. Annual dinner.

Institute of Welding

London: Institution of Civil Engineers, Great George Street, S.W.1, 6.30 p.m. Presidential address by A. Robert Jenkins.

Institute of Packaging

Manchester: Grand Hotel, 6.30 p.m. Northern Area. Fifth annual dinner.

THURSDAY 9 OCTOBER

Society of Chemical Industry

Liverpool: University, 6.30 p.m. Liverpool Section. L. J. Burrage: 'Safety in the Chemical Laboratory and on the Plant: Protection of the Individual.'

Nottingham: Odeon Café, Angel Row, 7.30 p.m. Nottingham Section. H. Baines: 'Seeing the Invisible.'

Institute of Metal Finishing

Manchester: Engineers' Club, Albert Square, 7.30 p.m. P. A. Cartwright: 'The Chemical Cleaning of Metals.'

Incorporated Plant Engineers

Newcastle-on-Tyne: Roadway House, Oxford Street, 7.30 p.m. D. Curran (Pilkington Bros., Ltd.): 'Manufacture of Glass and Some Aspects of Toughened Glass.'

Institute of Welding

Tyneside Branch: P. T. Houldcroft: 'Recent Developments in the Welding of Aluminium Alloys.' Details from local secretary.

FRIDAY 10 OCTOBER

Oil & Colour Chemists' Association

Manchester: Grand Hotel, 6.30 p.m. Dr. C. Bondy: 'The Use of Polyvinyl Acetate in Paints.'

Society of Glass Technology

St. Helens: Gas showrooms, Radiant House, 6 p.m. W. J. R. Merren: 'Can Research Be Organised?'

Institute of Welding

Bristol: South Western Branch. S. M. Reisser: 'Design for Welding.' Details from local secretary.

SATURDAY 11 OCTOBER

Society of Leather Trades' Chemists

Manchester: Engineers' Club, Albert Square, 2 p.m. M. Lovett: 'Trade Effluent Problems and Tannery Effluent'; J. Crosby Veale: 'Effluent Disposal: a Tanner's View.'

Law & Company News

The following are taken from the printed reports, but we cannot be responsible for errors that may occur

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

INDUSTRIAL CHEMICALS, LTD., London, W.C. (M., 4/10/52). 5 September, £750 debentures, part of a series already registered. *£11,250 debentures. 20 February, 1952.

PEST CONTROL, LTD., Bourn (Cambs.). (M., 4/10/52. 28 August, £12,000 mortgage, to W. Gotte, Fulbourn; charged on The Mansion, Chesterford Park, Great and Little Chesterford. *£633,527. 9 June, 1952.

Satisfaction

LEWIS BERGER & SONS, LTD., London, W., paint manufacturers. (M.S., 4/10/52). Satisfaction, 2 September of debentures registered 23 August, 1941.

New Registration

Benson Russell & Co., Ltd.

Private company. (511,486). Capital £500. Research workers, manufacturers of chemicals, metals, ores, ceramics, oils and by-products. Reg. office: 68 (d), Blackstock Road, N.4.

Company News

Imperial Chemical Industries, Ltd.

The directors of Imperial Chemical Industries, Ltd. announce that they have declared an interim dividend of 5 per cent (actual) in respect of the year ending 31 December, 1952, on the Ordinary stock of the company. The dividend will be payable on 1 December, less income tax at the United Kingdom standard rate for 1952/53, to members on the register on 10 October.

This increase in the rate of interim dividend (over the rate of 3 per cent for recent years) follows the intention of the board, expressed in the company's prospectus for the issue of new Ordinary shares earlier this year, that for 1952 and subsequent years the interim dividend should represent a greater proportion of the total annual distribution than hitherto.

For the purpose of payment of this dividend transfers in order must have been lodged at the company's transfer office, 34 Portland Place, London, W.1, not later than 3 October.

Phillips Petroleum Company

Consolidated gross income for the six months ended 30 June, 1952, $346,508,597 ($287,163,175). Net profit $38,933,442 ($32,002,597), equal to $2.70 ($2.46) a share.

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NEW GALVANISED PIPING. Immediate delivery. Johnson Filter **PRESSES,** 25 in., 18 Frame, practically new.
FIVE new **FURNACE RETORTS,** 8 ft. diam., 6 ft. 8 in. deep, approx. 8 tons each. Welded Steel.
BENZOLE WASHER, lead lined, agitating gear, 7 ft. diam., 6 ft. 6 in. deep.
FIVE Dish-ended **NAPHTHA TANKS,** 18 ft. 6 in. long by 4 ft. 4 in. diam., two having agitators.
NINE New Welded **TANKS,** 13 ft. 6 in. long, 7 ft. diam., 3,100 gallons each.
TWO 35 ft. long by 9 ft. diam. Lead-lined **TANKS.**
Stainless Steel **FILTER TANK,** 3 ft. 6 in. diam.
ONE Stainless **CONICAL HOPPER,** 7 ft. 3 in. diam., overall depth, 7 ft. 6 in.
TWO Broadbent **WATER-DRIVEN CENTRIFUGES,** 30 in. diam., 12 in. deep, 1,150 r.p.m., 150 lb. pressure.
FOUR Papier-mache O.T. **TANKS,** 8 ft. 3 in. diam., 9 ft. deep. (Unused.)
SIX O.T. TANKS, 7 ft. diam. 14ft. deep, lined inside with acid-resisting bricks.
SIX Aluminium **CONDENSERS,** 14 ft. long by 2 ft. 6 in diam. 386 Tubes, ¾ in. o.d.
FOUR Rectangular Lead-lined **TANKS,** 8 ft. by 4 ft. 6 in. by 2 ft. 6 in.
FORTY Riveted **RECEIVERS,** 8 ft. 6 in. long, 5 ft. 6 in. diam., 75 lbs. w.p.
CAST-IRON PIPES, 5000 ft. Each 6 in. and 8 in.
VALVES in Stainless, Gunmetal, Enamel Lined.
Free Catalogue, "Watkins Machinery Record," available.

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MORTON, SON AND WARD LIMITED
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ONE 48 in. BROADBENT, with stainless steel imperforate basket, complete with skimmer attachment. Electrically driven.
TWO 48 in. BROADBENT, Type 4, electrically under-driven, steel galvanised baskets.
ONE 48 in. BROADBENT, with lead-lined monitor and ebonite-covered basket. Steam driven.
ONE 60 in. BROADBENT, electrically under-driven, steel galvanised basket.
ONE 72 in. BROADBENT, electrically under-driven, steel galvanised basket.
All the above machines are 3-point suspension type complete with baseplates. All the electrically driven are complete with starters and suitable for 400/3/50 supply.
TWO 42 in. by WATSON LAIDLAW, under-driven through Vee-ropes from flange-mounted vertical spindle motor, complete with starter. 400/3/50 supply.
ONE 48 in. by BROADBENT, all electric, (lift out basket type).
TWO de Laval Motorised Centrifugal **SEPARATORS,** 150 gallons per hour.
THREE Hopkinson Motorised Centrifugal **SEPARATORS,** 150/200 g.p.h. Types 1 and 2.

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"MORWARD" "U"-shaped TROUGH POWDER MIXERS in sizes 8 to 100 cu. ft. Arranged with scroll-type mixing gear.
WE SPECIALISE IN MAKING MIXERS, JACKETED AND UNJACKETED, TO SUIT REQUIREMENTS.

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NEW 100g., 150g. and 200g. in mild steel, suitable for 80/100 p.s.i. w.p.
SECOND-HAND, one 200g. in cast iron, arranged with nickel-chrome mixing gear, totally enclosed, fume-tight cover.
ONE 1,500g. in mild steel, second-hand.
SEVERAL 40/60g. second-hand, in mild steel and cast iron available.
All the above can be fitted with mixing gear to requirements.

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A large selection of **PUMPS** in stock—**MONOS, DRYSDALES,** etc.—1 in. 2 in., 3 in., 5 in. and 6 in. New and second-hand.
Numerous all-bronze, brass tube, **CONDENSERS** or **HEAT EXCHANGERS** by Serck in stock.

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1 Barron "D" MIXER, TROUGH 30 in. by 18 in by 18 in. Vee-belt drive to 2 H.P. motor, 750 revs 400/3/50. As new.
One Werner Type MIXER, TROUGH 36 in. by 30 in. by 28 in. Twin "Z"-blades, power tilted, fast and loose pulley drive.

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ONE 1½ size Harrison Carter **DISINTEGRATOR.** Enclosed **STORAGE TANK,** 5 ft. 8 in. by 11 ft. 8 in. by 10 ft., deep, in Buckingham.

Two Miracle No. 1 size **HAMMER MILLS,** belt driven with fans and cyclones.

Three Perplex-type **IMPACT GRINDERS,** 24 in. and 30 in. circular grinding chambers.

Two Turner 2½-sheet No. 2 **DRESSING MACHINES,** ball bearing.

Size No. 3 Junior Hammamac **HAMMER MILL** with fan and cyclone, also No. 1 size Miracle **GRINDING MILLS.**

Robinson 3-sheet No. 1 size **CENTRIFUGAL DRESSING MACHINE** for dry powders, etc.

Two **ROTARY BOWL MIXERS,** 5 ft. diam., cast-iron built, inclined agitators by Baker Perkins

One excellent **EVAPORATING UNIT,** comprising Copper Vessel, 4 ft. diam. by 5 ft. 6 in. deep, jacketed on the bottom, with copper swan-neck, C.I. catch-pot, vacuum pump and fittings including thermometer and gauge.

Large unjacketed **WERNER MIXER,** belt and gear driven, hand tipping, double " Z " arms, pans 31 in. by 45 in. by 36 in. deep.

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No. 209 One **HORIZONTAL " U "-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

One **FILTER PRESS,** fitted 68 wood recessed plates, 2 ft. 8 in. square, centre fed, with enclosed bottom corner delivery, cloth clips and belongings.

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ROTARY LOUVRE DRIER by Dunford & Elliott, 25 ft. by 7 ft. 6 in. diam. M.S. shell ¼ in. thick. M.S. radial louvres ⅛ in. thick. Stainless steel double tangential louvres ⅛ in. thick and stainless steel feed cone. Inside of shell and both sides double louvres sprayed 0.002 in. zinc covered by 0.006 in. aluminium. Drum carried on two roller paths and driven through girth gear and pinion from worm gear reduction box and 15 h.p. motor. Complete with inlet and outlet centrifugal fans, the exhaust fan metal sprayed and inside of casing lithcoted. PLANT NEW AND UNUSED.

ROTARY DRYING INSTALLATION by Dunford & Elliott, comprising Rotary Louvre Dryer, 20 ft. by 4 ft. 6 in. diam., running on two roller paths. Arranged 4 h.p. electric motor drive through reduction gearbox to main girth gear. Heating arrangements comprise gilled type air heater using steam at 80 lb. pressure. Complete with cyclone, 7½ h.p. motorised Sturtevant fan with 27 in. diam. by 12 in. paddle, and low velocity exhaust hood equipped with motorised fan.

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Stainless Steel Jacketed Cylindrical Gas-heated **MIXER,** 22½ in. diam. by 36 in. deep.
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Stainless Steel **RUMBLER,** 4 ft. diam. by 2 ft.
Jacketed Vacuum Twin Z-blade Brass-lined **MIXER,** 28 in. by 26 in. by 20 in.
FILLERS, HYDROS, CONDENSERS, BOILERS, PUMPS, AUTOCLAVES.
Lists of MIXERS, TANKS and RADIATORS, on request.

HARRY H. GARDAM & CO., LTD., STAINES.

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TRANSLATIONS (Technical, Commercial), all languages Abstracts also supplied. **Olympia Translation Service 149, Blythe Road, London, W.14. RIVerside 5135.**

PATENTS & TRADE MARKS

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ADVERTISER wishes a confidential arrangement with a British firm to wet process (tank washing and drying) 15 tons to 25 tons monthly of a crude material similar to a dry colour. This processing may be arranged on a custom basis. Material is to be finished, bagged and made ready for export, mainly to U.S.A. Midlands area preferred. **BOX No. C.A.3167,** THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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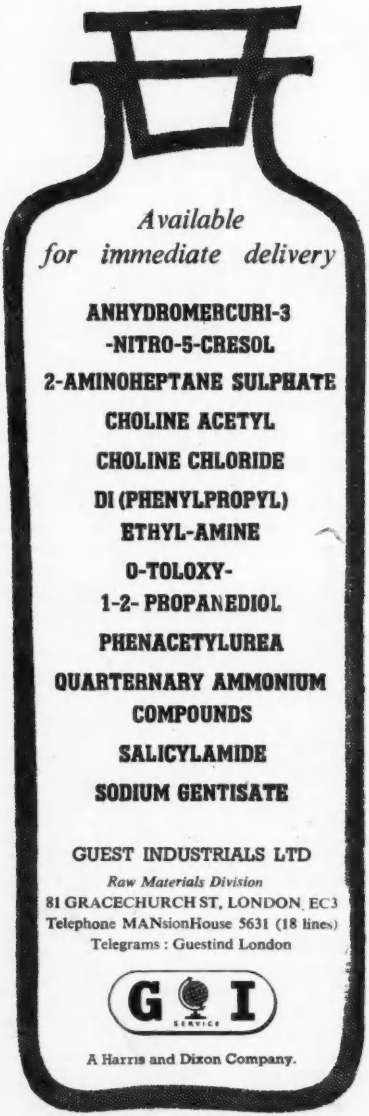

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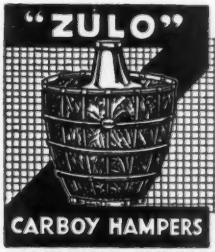

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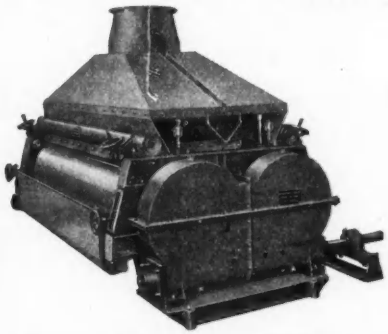

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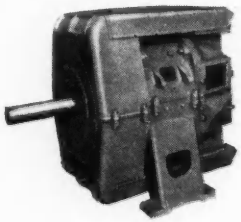

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